Environment Canada Environnement Canada

OCEAN DISPOSAL CONTROL PROGRAM

OCEAN DISPOSAL ACTIVITIES SUMMARY 1996

REGIONAL PROGRAM REPORT: 97-30

PACIFIC AND YUKON REGION

Canada

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Errata for Ocean Disposal Activities Summary 1996 Pacific and Yukon Region

Page 3, Table 1
The volume disposed of at the Point Grey disposal site in 1996 was 660,810 cubic metres.

Page 3, Table 1
Material reported to have been disposed of at Squamish disposal site was actually sent to the Mamquam Channel disposal site (disposal site number 175, co-ordinates 49°41.50'N; 123°09.50'W).

Page 3, Table 1
The total volume disposed of at disposal sites in the Pacific and Yukon Region in 1996 was 926,232 cubic metres and 2,963 tonnes.

Section 5.0 Active Disposal Site Information

Page	Disposal Site	Total Quantity Disposed Since 1976
10	Point Grey	7 953 136 cubic metres + 390 tonnes
15	Sand Heads	9 896 425 cubic metres
17	Victoria	289 403 cubic metres + 31 105 tonnes
19	Porlier Pass	153 475 cubic metres
20	Five Finger Island	202 622 cubic metres
22	Malaspina Strait	503 600 cubic metres + 6000 tonnes
29	Tahsis Inlet	172 385 cubic metres
33	Port Alberni	939 423 cubic metres
36	Kitimat Arm	63 555 cubic metres
40	Muchalat Inlet	186 961 cubic metres
44	Johnstone Strait - Hickey Point	154 187 cubic metres + 40 tonnes
46	Mamquam Channel	6 450 cubic metres

Page 10, Paragraph 2
…In addition, 444 000 cubic metres of excavation material were taken to the disposal site.

Page 46, Section 5.20
Material reported to have been disposed of at the Squamish disposal site was actually disposed of at the Mamquam Channel disposal site. Details of the correction are presented below.

5.20 Mamquam Channel

Disposal Site:	Mamquam Channel
Number:	175
Co-ordinates:	49°41.50'N; 123°09.50'W
Depth:	15 metres
Total Quantity Disposed Since 1976:	6 450 cubic metres

Comments

Loading and disposal activities will be restricted to periods which will not impose a threat to biological resources. These periods are specified buy the DFO Habitat Management Unit in Nanaimo.

Loadsite Information

Maintenance dredging activities in Mamquam Channel resulted in the disposal of 6 450 cubic metres of material at the Mamquam Channel disposal site this year.

OCEAN DISPOSAL ACTIVITIES SUMMARY

1996

PACIFIC AND YUKON REGION

ENVIRONMENT CANADA
ENVIRONMENTAL PROTECTION

PACIFIC AND YUKON REGION

Report No. 97-30

Regional Program Report by:

C. Schnider
D.L. Sullivan

ABSTRACT

Environment Canada's administration of the Canadian Environmental Protection Act (CEPA) Part VI, regarding ocean disposal of wastes, is summarized in this report. Disposal activities from January 01, 1996 to December 31, 1996 in the Pacific and Yukon Region are specifically documented. The sites in this region are used primarily for disposal of dredge and excavation spoils. Activities at these sites from 1975 to 1995 have been compiled in a series of reports by Ward and Sullivan (1980), Sullivan (1987), Kim and Sullivan (1993), Kim et al.(1997), Sullivan et al.(1997), and Schnider and Sullivan (1997). This report is a continuation of this series and includes information on 22 disposal sites that were active in the Pacific and Yukon Region in 1996. Data is presented for monitoring done at 12 of these sites.

RÉSUMÉ

Ce rapport concerne les activités d'Environnement Canada en matière d'application de la partie VI de la Loi canadienne sur la protection de l'environnement (LCPA) (dépôts de déchets en mer). Il traite plus spécifiquement d'activités de dépôt qui ont eu lieu du 1er janvier au 31 décembre 1996 dans certains sites de la région du Pacifique et du Yukon. Les sites de cette région servent principalement du dépôt des materiaux de dragage et d'excavation. Les activités de dépôt pour la période comprise entre 1975 et 1995 ont été compilées dans une série de rapports préparés par Ward et Sullivan (1980), Sullivan (1987), Kim et Sullivan (1993), Kim et al. (1997), Sullivan et al. (1997) et Schnider et Sullivan (1997). Ce rapport s'incrit dans cette série et contient de l'information sur les activités de 22 sites de dépôt dans la région du Pacifique et du Yukon au cours de l'année 1996. Les données fournies concernent les contrôles effectués dans 12 de ces sites.

ACKNOWLEDGMENTS

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1.0 INTRODUCTION

Environment Canada has administered the requirements for ocean disposal of wastes since 1975 under authority of the Ocean Dumping Control Act (ODCA). In 1988 this legislation was replaced by the Canadian Environmental Protection Act (CEPA), Part VI. Material destined for ocean disposal requires a permit issued by Environment Canada. To ensure compliance with the conditions of the permit, inspections are routinely conducted by Environment Canada, Enforcement and Emergencies Division.

Within Canada, ocean disposal sites are divided into four geographical regions: Atlantic, Prairie and Northern, Quebec, and Pacific and Yukon (Figure 1 shows the Pacific and Yukon Region). This report describes all ocean disposal activities conducted in 1996 in the Pacific and Yukon Region. There are thirty-five designated sites in the Region. In 1996, fifteen of these disposal sites were used and twelve were monitored (Table 1).

2.0 ADMINISTRATION

2.1 APPLICATION AND REVIEW PROCESS

Under the authority of CEPA Part VI, material destined for ocean disposal or loaded for the purpose of ocean disposal requires an Ocean Disposal Permit. Permit applications are reviewed by Environment Canada with advice from the Regional Ocean Disposal Advisory Committee (RODAC). This committee has representation from Environment Canada, the Department of Fisheries and Oceans and the British Columbia Ministry of Environment, Lands and Parks. Information on the application process can be obtained from Environment Canada, 224 West Esplanade, North Vancouver, B.C., V7M 3H7. Figure 2 shows the complete permitting process.

The public is advised of the application via a Notice of Intent that the applicant publishes in a newspaper local to the area of the proposed activity. The public can address their comments to Environment Canada throughout the application review process. All environmental screenings can be viewed by the public at the Canadian Environmental Assessment Act (CEAA) Public Registry at 224 West Esplanade, North Vancouver, B.C., V7M 3H7.

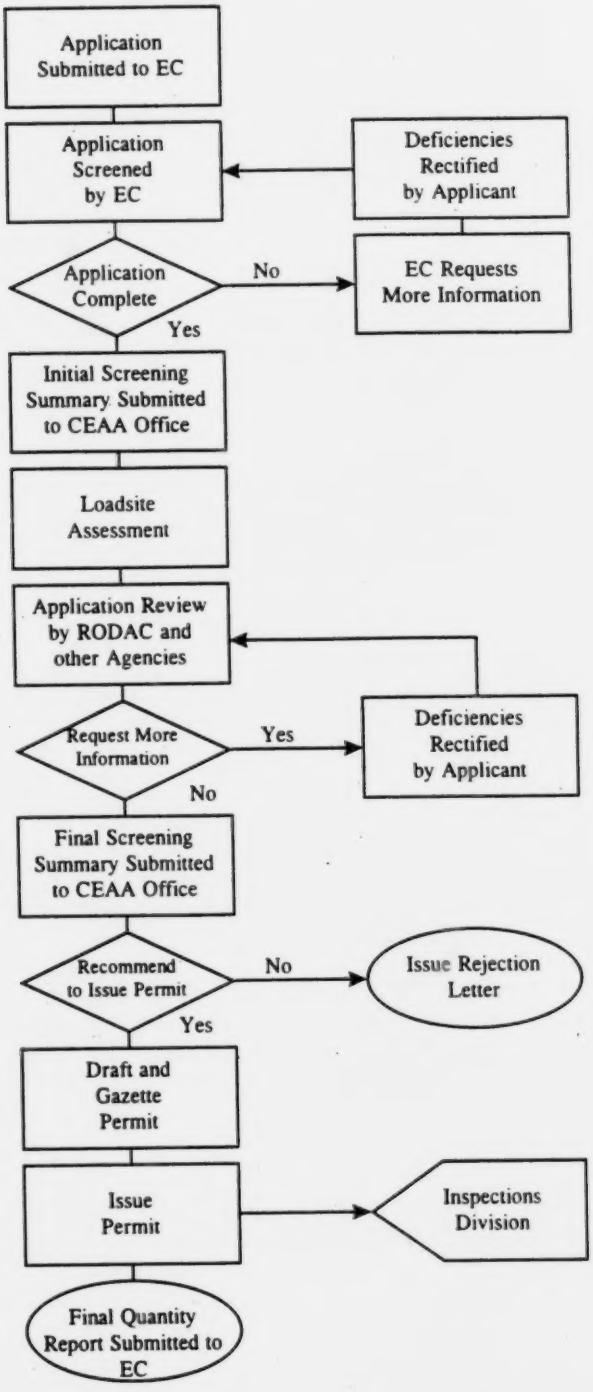
Based on the initial review of an application, inspection and sampling may be required. Following the application review process, only material which has been rigorously tested and found to meet the criteria outlined in the Interim Contaminant Testing Guidelines for Ocean Disposal, Pacific & Yukon Region (ICTG, Appendix I), is approved for ocean disposal. All ocean disposal permits and amendments must be published in the Canada Gazette before they are issued. After a permit has been published in the Canada Gazette, a one week time period is reserved for public comments and concerns before a permit becomes effective. Permits are valid for a one year period.

Figure 1. Location map.

Table 1. Active ocean disposal sites.

Number	Disposal Site	Co-ordinates	Volume Disposed in 1996
* 1	Point Grey	49°15.40'N; 123°22.10'W	653,419 m^3
* 9	Sand Heads	49°06.00'N; 123°19.50'W	23,300 m^3
* 14	Victoria	48°22.30'N; 123°21.80'W	0 m^3
32	Porlier Pass	49°00.20'N; 123°29.80'W	4,500 m^3
40	Five Finger Island	49°15.20'N; 123°54.60'W	3,900 m^3
48	Comox (Cape Lazo)	49°41.70'N; 124°44.50'W	4,000 m^3
* 49	Malaspina Strait	49°45.00'N; 124°27.00'W	25,561 m^3
* 64	Thornbrough Channel	49°31.00'N; 123°28.30'W	8,000 m^3
* 65	Watts Point	49°38.50'N; 123°14.00'W	0 m^3
* 83	Tahsis Inlet	49°51.60'N; 126°39.60'W	0 m^3
* 86	Newcombe Channel	48°54.70'N; 125°29.30'W	0 m^3
* 88	Port Alberni	49°11.80'N; 124°49.30'W	400 m^3
93	Kitimat Arm	53°58.00'N; 128°41.50'W	100 m^3
100	Brown Passage	54°18.70'N; 130°45.00'W	563 tonnes
* 116	Cape Mudge	49°57.70'N; 125°05.00'W	0 m^3
* 117	Muchalat Inlet	49°39.00'N; 126°14.90'W	0 m^3
* 118	Eliza Passage	49°40.80'N; 126°34.30'W	0 m^3
119	Johnstone Strait - Hickey Point	50°27.80'N; 126°04.80'W	3,600 m^3
120	Johnstone Strait - Hanson Island	50°33.50'N; 126°48.00'W	6,000 m^3
164	Squamish	49°40.70'N; 123°10.90'W	6,450 m^3
174	Shingle Bay, Q.C.I.	53°14.95'N; 131°52.10'W	179,600 m^3
178	Maud Island	50°08.00'N; 125°14.80'W	2,400 tonnes
TOTAL			**918,830 m^3 + 2,963 tonnes**

* Monitoring studies were conducted at these disposal sites in 1996.



RODAC Agencies

DOE -	Pollution Prevention and Assessment Division
DFO -	Science and Research
DFO -	Habitat Management
MOELP -	Pollution Prevention and Remediation Branch

Legend

EC -	Environment Canada
RODAC -	Regional Ocean Disposal Advisory Committee
MOELP -	Ministry of Environment, Lands and Parks
DFO -	Department of Fisheries and Oceans
CEAA -	Canadian Environmental Assessment Act

Figure 2. Ocean disposal permitting process.

Maintenance dredging activities involving less than 4 000 cubic metres of dredged material, or excavation projects involving clean native till may be undertaken under the terms and conditions of a general ocean disposal permit. New dredging projects or maintenance activities involving volumes in excess of 4 000 cubic metres require a site specific permit.

2.2 OCEAN DISPOSAL RESTRICTIONS

Under Schedule III, Parts I and II, certain substances are prohibited or restricted from ocean disposal. In addition, the ICTG further outline the criteria for polynuclear aromatic hydrocarbons, polychlorinated biphenyls, chlorophenols and dioxins/furans.

The substances listed in Part I are generally prohibited when present at concentrations in excess of those specified below unless, in the opinion of the Minister, the substance will be rapidly rendered harmless by physical, chemical or biological processes of the sea at the specified disposal site:

a) Organohalogen compounds

• Chlorophenols (PCP and TCP)	1.0 µg/g
• Polychlorinated biphenyls (PCB)	0.1 µg/g
• Polynuclear aromatic hydrocarbons (PAH)	* 2.5 µg/g
• Dioxin (2,3,7,8 TCDD)	* Quantifiable

* ICTG rejection limit

b) mercury and mercury compounds in a solid phase of a waste (0.75 µg/g), and in the liquid phase of a waste (1.5 µg/g);

c) cadmium and cadmium compounds in the solid phase of a waste (0.6 µg/g), and in the liquid phase of waste (3.0 µg/g);

d) persistent plastics and other persistent synthetic materials (four percent by volume), in a suitably comminuted form;

e) crude oil and its wastes, refined petroleum products, petroleum distillate residues and any mixtures containing any of those substances (any quantity that yields more than 10.0 µg/g of n-hexane soluble substances);

f) radioactive wastes and other radioactive matter;

g) substances in whatever form produced for biological and chemical warfare; and

h) industrial waste, namely, material that comes from manufacturing or processing operations and is waste, other than:

- dredged material
- fish waste or other organic matter that comes form industrial fish processing operations;
- ships, platforms or other anthropogenic structures at sea, provided that material capable of creating floating debris or otherwise polluting the marine environment has been removed;
- uncontaminated inert geological material; and
- uncontaminated organic matter of natural origin.

Under Part II, the following substances are restricted when present in significant amounts. In dredged material, lead is considered to be present in significant amounts when contained in wastes at concentrations of 0.05 percent or more by weight (500 µg/g) and arsenic, copper, zinc, beryllium, chromium, nickel and vanadium when present at concentrations of 0.1 percent (1000 µg/g). Pacific RODAC considers these levels as general guidelines only and may impose more stringent limits.

a) arsenic and its compounds;
b) lead and its compounds;
c) copper and its compounds;
d) zinc and its compounds;
e) organosilicon and its compounds;
f) cyanides;
g) fluorides;
h) pesticides and their by-products not included in the List of Prohibited Substances in Part I;
i) beryllium and its compounds;
j) chromium and its compounds;
k) nickel and its compounds;
l) vanadium and its compounds;
m) containers and scrap metal;
n) substances that by reason of their bulk would interfere with fishing; and
o) substances that, though of a non-toxic nature, may become harmful due to the quantities in which they are dumped, or that are liable to seriously reduce amenities.

In order to protect fisheries resources, spawning areas, and juvenile and adult migratory areas, the Department of Fisheries and Oceans (DFO) requires that dredging and/or ocean disposal activities be conducted within time frames specified by district Habitat Management Units. Proponents are directed to contact the appropriate DFO units prior to commencing any projects for timing restrictions relevant to the area of proposed activities. For example, Fraser River dredging guidelines for operations within

navigation channels specify periods when clamshell or suction dredging is allowed. Dredging outside navigation channels is reviewed on a site-specific basis.

2.3 COMPLIANCE AND ENFORCEMENT

Environment Canada, Pollution Prevention and Assessment Division, conducts pre-load inspections to confirm sampling program design and collects samples as required. Enforcement of the terms and conditions of permits under CEPA, Part VI, is the responsibility of the Inspections Section, Enforcement and Emergencies Division. CEPA inspectors routinely conduct compliance and surveillance inspections of dredging/loading and disposal operations. Vessel Traffic Management Centres monitor disposal sites to ensure disposal activities occur at the authorized locations. Any contravention of permit conditions are dealt with under authority of CEPA, Part VI or Section 36 (3) of the *Fisheries Act*.

3.0 ENVIRONMENTAL ASSESSMENT

Under Phase II of the Green Plan initiative, environmental assessment procedures are being revised. The Interim Monitoring Guidelines for Ocean Disposal were developed and field tested in 1993 and 1994. Three of five biological testing protocols - the Marine Amphipod Acute Toxicity Test, the Echinoid Fertilization Assay and the Bacterial Photoluminescence test (Microtox®) - completed in 1992, were used in sea trials to assess their value in disposal site assessment. Development continues on the Polychaete Growth test and the Bioaccumulation assay protocols.

In addition, Environment Canada published 'Guidance Document on the Collection and Preparation of Sediments for Physicochemical Characterization and Biological Testing' in December 1994. Biological monitoring guidelines and technical guidance on physical monitoring documents are also being prepared for use in the program.

4.0 OCEAN DISPOSAL ACTIVITIES

4.1 NUMBER OF PERMITS

In 1996, twenty-three ocean disposal permit applications were received and 23 permits were issued (Table 2); 6 for excavated material, 15 for dredged material and 2 for vessels.

Table 2. Number of permits issued in the Pacific and Yukon Region - 1987 to 1996.

Permit Type	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total
Dredge	33	41	28	25	23	20	21	18	20	15	244
Excavation	2	5	5	4	4	5	3	2	4	6	40
Vessel	0	0	1	0	2	2	0	0	1	2	8
Others	2	2	2	2	1	0	1	0	0	0	10

Under general permits for dredged and excavated materials, 119 projects were assessed and approved in 1996. Fifty approvals were issued for excavation projects in the lower mainland and 69 approvals were issued for projects involving less than 4 000 cubic metres of dredged material.

4.2 VOLUME OF MATERIAL OCEAN DISPOSED

In 1996, approximately 890 000 cubic metres of material was disposed of at ocean disposal sites (Table 1). Over 70% of all materials ocean disposed of in 1996 were sent to the Point Grey disposal site.

More than 50 percent of the total volume ocean disposed in 1996 resulted from excavation projects in the lower mainland.

The volume of dredged material disposed of each year is greatly affected by the amount of river sediment that is dredged from the Fraser River for maintenance purposes. Since 1990, an average of 800 000 cubic metres of material composed almost entirely of sand has been taken to Point Grey and Sand Heads disposal site annually. In 1996, however, Fraser River maintenance activities produced only 6 200 cubic metres of material. This may be due in part to an abnormally high volume of material taken out in surrounding years. It may also be due to the facilities that are presently being developed for sand recovery. Material that in past years would have been sent to Sand Heads disposal site is now being recovered by Public Works Canada and sold for profit.

4.3 MONITORING

Routine monitoring of ocean disposal sites is carried out by Environment Canada to assess physical, chemical and biological effects of disposal operations. In the Pacific and Yukon Region, ocean disposal sites are designated by RODAC. At each disposal site, a grid of sediment sampling stations has been established to allow repeat surveys.

In 1996, seven active disposal sites - Point Grey, Cape Mudge, Malaspina Strait, Thornbrough Channel, Victoria, Sand Heads and Watts Point - and five inactive disposal sites - Muchalat Inlet, Port Alberni, Eliza Passage, Newcombe Channel and Tahsis Inlet - were monitored to establish chemical concentrations and physical characteristics of sediments at each site. All sediments collected were analysed for trace metals, and particle size distribution. Sediment from all sites, with the exception of Point Grey, Newcombe Channel and Cape Mudge disposal sites, were also analysed for total organic carbon and total PAHs.

Sediment toxicity tests are conducted to determine and monitor effects of sediments on the receiving environment. Sediment from the Malaspina Strait disposal site was tested for toxicity using the marine amphipod acute toxicity test using *E. washingtonianus* and the solid phase Microtox® test. Results are presented in Section 5.7.

In March 1996, video images of Point Grey disposal site were recorded using a remotely operated submersible, ROPOS (Remotely Operated Platform for Ocean Science). ROPOS followed predetermined transect lines across the disposal site to examine bottom conditions and evidence of ocean disposal activities. Discussion of the physical monitoring conducted at Point Grey is presented in Section 5.1.

5.0 ACTIVE DISPOSAL SITE INFORMATION

The total quantity of materials found under disposal headings in the following sections is the total quantity disposed of under permit/approval since 1976. Information on specific permits and approvals in 1996 at each disposal site can be found in the Ocean Disposal Site Summaries in Appendix II.

Where trace metal concentrations are reported in the following sections, results are expressed as total metals.

5.1 POINT GREY

Disposal Site:	Point Grey
Number:	1
Co-ordinates:	49°15.40'N; 123°22.10'W
Depth:	210 metres
Total Quantity Disposed Since 1976:	7 791 146 cubic metres

Comments

The Department of Fisheries and Oceans (DFO) requests that Vancouver Harbour and the Fraser River Dredging Guidelines be applied to any dredging projects, subject to approval by the appropriate Habitat Management Unit.

Loadsite Information

Maintenance dredging operations at various locations in Vancouver Harbour and the Fraser River resulted in 186 000 cubic meters of dredged material being sent to the Point Grey disposal site. In addition, 437 000 cubic meters of excavation material from the Lower Mainland was taken to the disposal site. Disposal of excavation material has increased about 10% each year since 1987. Much of this increase is due to the decreasing availability and feasibility of landfill options.

Monitoring Information

From September 23 to October 30, an extensive physical monitoring survey was completed at the Point Grey disposal site. During this period, the east side of the disposal site was closed to ocean disposal activities. Complete details of this study will be available in 1998.

As part of the physical monitoring survey, surface sediment samples were collected from 25 stations at the Point Grey disposal site in September and then again in October. Samples were analysed for trace metals and particle size distribution. Results are presented in Tables 3 and 4. No chemical concentrations exceeded the screening limits outlined in the ICTG.

Comparisons of results from both surveys were made to determine whether significant changes in chemistry or grain size content occur during a small period of time. It was found that there were no significant changed in sediment chemistry from one survey to the next.

Statistical analyses on the grain size data showed that for areas where no disposal occurred, there was no significant change in grain size. However, where disposal

occurred (only the West side of the disposal site), there was a significant increase in sand content and a decrease in fine sediment.

This may suggest that disposal activities are contributing to a higher percentage of coarse sediment at the disposal site than is present in surrounding waters. This can be verified by examining the particle size content of the disposal site versus that of stations 17-24, located outside of the disposal site boundaries. It is apparent that the sediment outside of the disposal site is composed of a greater percentage of silt and sand, and a lower percentage of coarse material than is within the disposal site boundaries.

In March 1996, the remotely operated submersible ROPOS, was deployed at the Point Grey disposal site. Video images of the seabed condition were recorded on transect lines across the disposal site. It was observed that much of the material discharged at the site remains within the disposal site boundaries once it reaches the seabed. It was also noted that there is significant colonization of the disposal site area by many varieties of marine organisms. ROPOS video images can be viewed at Environment Canada, 224 West Esplanade, North Vancouver, B.C.

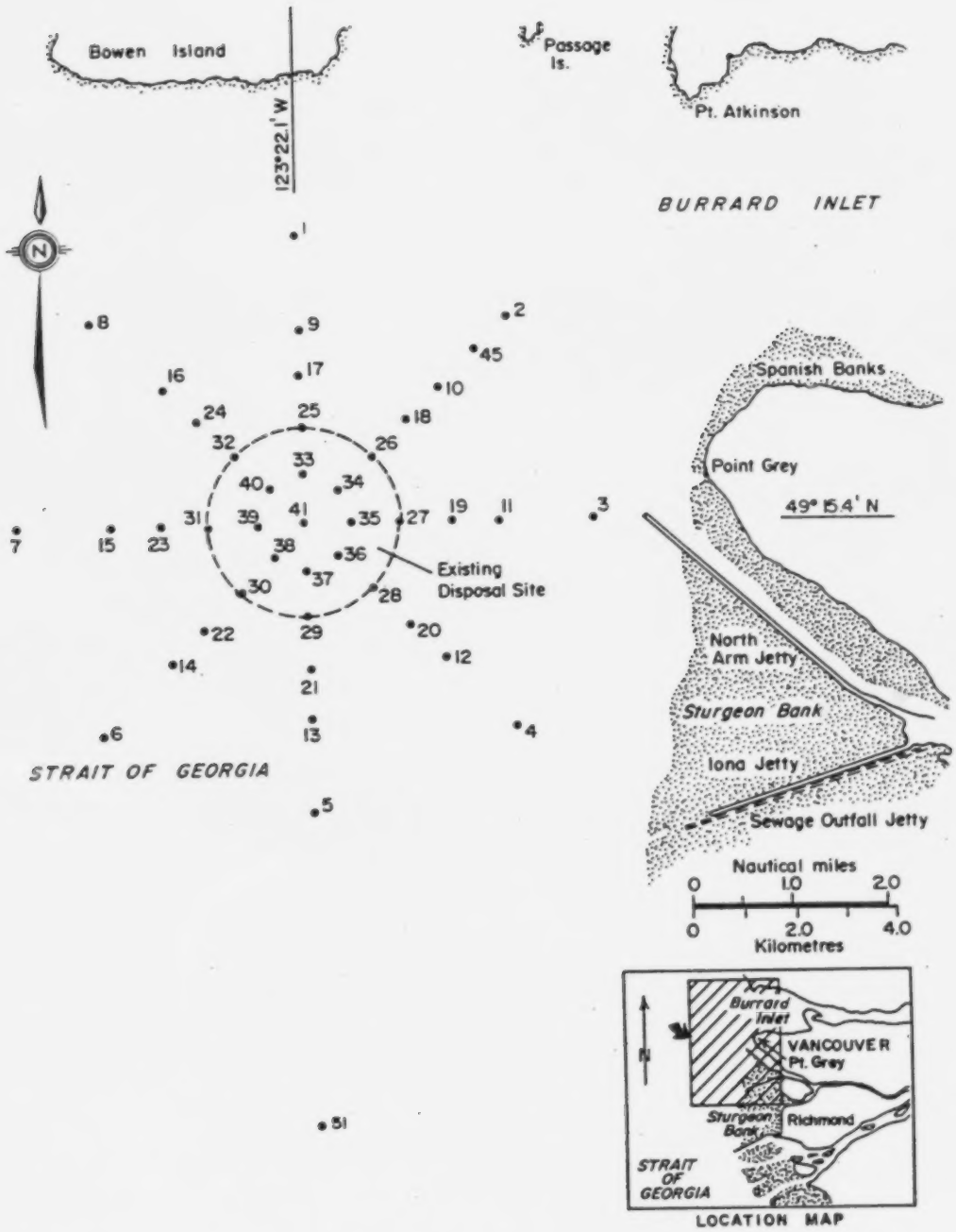


Figure 3. Point Grey disposal site sediment sampling stations.

Table 3. Point Grey sediment chemistry and particle size - September 1996 survey.

Station	Sediment Chemistry[1]					Particle Size (%)			
	Cd µg/g	Cu µg/g	Hg µg/g	Pb µg/g	Zn µg/g	Gravel > 2.0 mm	Sand 2 - 0.063 mm	Silt 0.063 - 0.004 mm	Clay < 0.004 mm
17	0.10	40.2	0.077	12	83.9	0.0	14.3	43.1	42.6
18	0.20	42.6	0.076	13	86.1	0.6	11.4	44.4	43.6
19	0.16	45.1	0.082	13	92.8	0.0	2.0	49.2	48.8
20	0.10	43.3	0.079	13	91.4	0.1	3.1	49.0	47.8
21	0.10	40.8	0.080	13	90.8	0.1	5.2	48.2	46.5
22	0.10	41.4	0.086	14	91.7	0.0	1.3	46.4	52.3
23	0.10	47.9	0.134	17	96.9	0.0	8.8	39.6	51.6
24	0.10	47.9	0.097	16	94.8	0.0	6.3	38.7	55.0
25	0.20	39.8	0.073	11	80.4	0.6	20.0	39.7	39.7
26	0.08	20.9	0.027	4	39.1	4.2	68.0	16.3	11.5
27	0.10	33.2	0.041	8	61.0	0.6	48.5	27.2	23.7
28	0.17	41.3	0.079	11	86.8	0.7	10.8	47.8	40.7
29	0.20	41.1	0.077	11	87.2	0.0	8.1	46.4	45.5
30	0.10	43.0	0.082	< 8	92.0	0.0	5.2	46.0	48.8
31	0.10	44.6	0.088	14	126.0	2.0	15.6	38.0	44.4
32	0.10	38.3	0.098	11	76.7	0.3	16.7	38.4	44.6
33	0.20	39.7	0.063	11	80.9	1.5	26.5	42.0	30.0
34	0.10	30.6	0.045	6	53.3	1.8	58.9	24.2	15.1
35	0.10	29.1	0.051	8	63.5	4.3	30.4	38.3	27.0
36	0.20	40.2	0.034	5	57.9	0.6	12.5	57.2	29.7
37	0.20	35.4	0.055	9	73.3	1.8	23.7	40.7	33.8
38	0.20	38.3	0.063	10	108.0	7.1	17.8	38.8	36.3
39	0.18	33.9	0.063	9	69.3	1.8	32.4	36.5	29.3
40	0.20	33.2	0.060	10	68.1	2.3	33.1	32.9	31.7
41	0.10	24.6	0.026	7	48.2	15.0	49.0	22.1	13.9

[1] Trace metal analyses are presented as total metals.

Table 4. Point Grey sediment chemistry and particle size - October 1996 survey.

Station	Sediment Chemistry[2]					Particle Size (%)			
	Cd	Cu	Hg	Pb	Zn	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	µg/g	> 2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	< 0.004 mm
17	0.10	42.8	0.074	12	92	0.0	14.3	42.6	43.1
18	0.10	42.9	0.080	11	89	0.2	11.7	45.7	42.4
19	0.20	46.3	0.082	12	100	0.3	2.7	48.8	48.2
20	0.10	45.8	0.090	11	98	1.3	3.3	48.3	47.1
21	0.20	42.5	0.084	11	96	0.9	1.7	48.6	48.8
22	0.10	43.7	0.094	14	93	1.3	2.9	45.1	50.7
23	0.10	47.8	0.101	16	103	0.0	11.0	38.6	50.4
24	0.10	51.3	0.098	15	105	0.0	6.6	39.6	53.8
25	0.10	38.2	0.068	10	86	0.4	22.5	40.6	36.5
26	0.08	24.5	0.031	7	47	13.1	47.8	24.6	14.5
27	0.07	22.8	0.039	8	56	3.6	55.4	24.4	16.6
28	0.10	39.7	0.076	12	87	1.3	13.8	47.5	37.4
29	0.10	43.7	0.081	12	95	1.1	7.9	45.8	45.2
30	0.10	45.0	0.088	12	98	2.8	8.7	41.7	46.8
31	0.10	41.9	0.082	12	90	0.1	19.0	37.0	43.9
32	0.10	42.1	0.067	10	76	8.7	21.8	33.7	35.8
33	0.10	33.8	0.057	9	69	17.0	31.0	29.9	22.1
34	< 0.03	26.9	0.044	7	57	7.3	53.7	23.9	15.1
35	0.10	31.8	0.051	< 4	70	4.7	34.1	36.5	24.7
36	0.20	32.4	0.051	9	78	2.9	43.3	34.6	19.2
37	0.10	34.8	0.069	9	75	6.1	35.2	35.1	23.6
38	0.10	32.0	0.048	7	66	3.2	33.7	34.8	28.3
39	0.10	31.8	0.053	8	68	15.8	29.6	29.8	24.8
40	0.08	26.3	0.034	8	54	7.0	47.6	25.7	19.7
41	0.05	24.2	0.024	5	41	34.7	41.4	15.2	8.7

[2] Trace metal analyses are presented as total metals.

5.2 SAND HEADS

Disposal Site:	Sand Heads
Number:	9
Co-ordinates:	49°06.00'N; 123°19.50'W
Depth:	70 metres
Total Quantity disposed Since 1976:	9 678 379 cubic metres

Comments

The Fraser River Dredging Guidelines apply to all projects. Clamshell dredging may be conducted throughout the year, subject to site specific approval. Suction dredges must operate at five metres depth at low tide from March 1 to June 1, and in even-numbered years, is prohibited from April 15 to May 15 during downstream pink salmon migration.

The DFO Habitat Management Unit in New Westminster should be contacted for specific timing restrictions for disposal.

Loadsite Information

Only clean sand, silt and gravel, (no woodwastes) are approved for disposal at the Sand Heads disposal site. The majority of material disposed of at this site originates from Fraser River channel maintenance projects by Public Works and Government Services Canada.

Monitoring Information

Three samples were taken from the Sand Heads disposal site in April 1996. Chemical analyses and particle size data are presented in Table 5. The sediment from Sand Heads disposal site is composed of mainly sand and silt. There were no concentrations found that exceeded the ICTG limits.

Table 5. Sand Heads sediment chemistry and particle size - April 1996 survey.

	Sediment Chemistry[3]					Particle Size (%)			
Station	**Cd** µg/g	**Pb** µg/g	**Hg** µg/g	**TPAH** µg/g	**TOC** %	**Gravel** >2.0 mm	**Sand** 2 - 0.063 mm	**Silt** 0.063 - 0.004 mm	**Clay** <0.004 mm
1	0.10	7	0.074	0.16	0.63	0.4	38.0	44.5	17.1
2	0.10	5	0.066	0.15	0.57	3.4	54.3	31.8	10.5
3	0.10	6	0.050	0.50	0.99	0.0	46.7	39.0	14.3

[3] Trace metal analyses are presented as total metals.

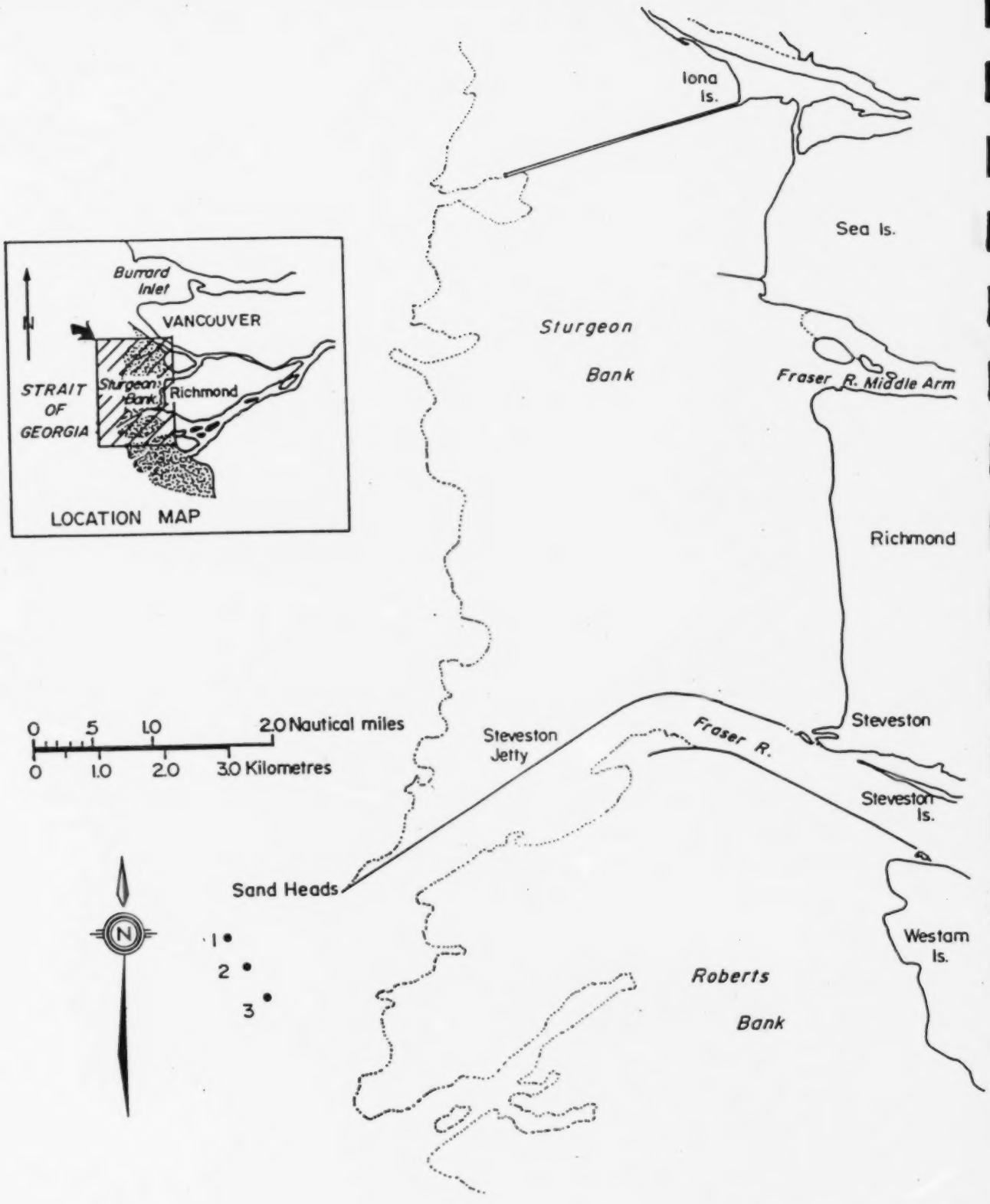


Figure 4. Sand Heads disposal site sediment sampling stations.

5.3 VICTORIA

Disposal Site: Victoria
Number: 14
Co-ordinates: 48°22.30'N; 123°21.80'W
Depth: 90 metres
Total Quantity Disposed Since 1976: 304 274 cubic metres + 305 tonnes

Comments

The DFO Habitat Management Unit in Nanaimo should be contacted for specific timing restrictions for dredging and disposal.

Loadsite Information

There was no material sent to the Victoria disposal site in 1996.

Monitoring Information

Sediment samples were collected from nine stations at the Victoria disposal site and from one reference station in the vicinity of the site in April 1996. Samples were analysed for trace metals and particle size. There were no concentrations found that exceeded the ICTG limits. Sediment at the Victoria disposal site is composed of a high percentage of gravel and sand, which is consistent with the dispersive nature of the area.

Table 6. Victoria sediment chemistry and particle size - April 1996 survey.

Station	Sediment Chemistry[4]					Particle Size (%)			
	Cd µg/g	Pb µg/g	Hg µg/g	TPAH µg/g	TOC %	Gravel > 2.0 mm	Sand 2 - 0.063 mm	Silt 0.063 - 0.004 mm	Clay < 0.004 mm
1	0.08	29	0.060	0.22	0.54	25.3	46.5	14.2	14.0
2	0.08	6	0.034	0.12	0.43	29.8	52.5	9.8	7.9
3	0.09	5	0.027	0.06	0.58	20.3	66.8	7.2	5.7
4	0.10	6	0.029	0.12	0.57	23.9	58.1	10.8	7.2
5	0.06	7	0.029	0.11	0.57	22.0	59.2	10.1	8.7
6	0.07	7	0.027	0.06	0.51	19.9	66.9	7.2	6.0
7	0.06	7	0.024	0.11	0.61	31.0	58.0	6.2	4.8
8	0.08	5	0.035	0.04	0.63	14.7	69.3	9.9	6.1
9	0.07	4	0.022	0.04	0.41	23.1	65.5	6.9	4.5
Reference (10)	0.04	5	0.043	0.06	0.41	0.0	88.6	5.3	6.1

[4] Trace metal analyses are presented as total metals.

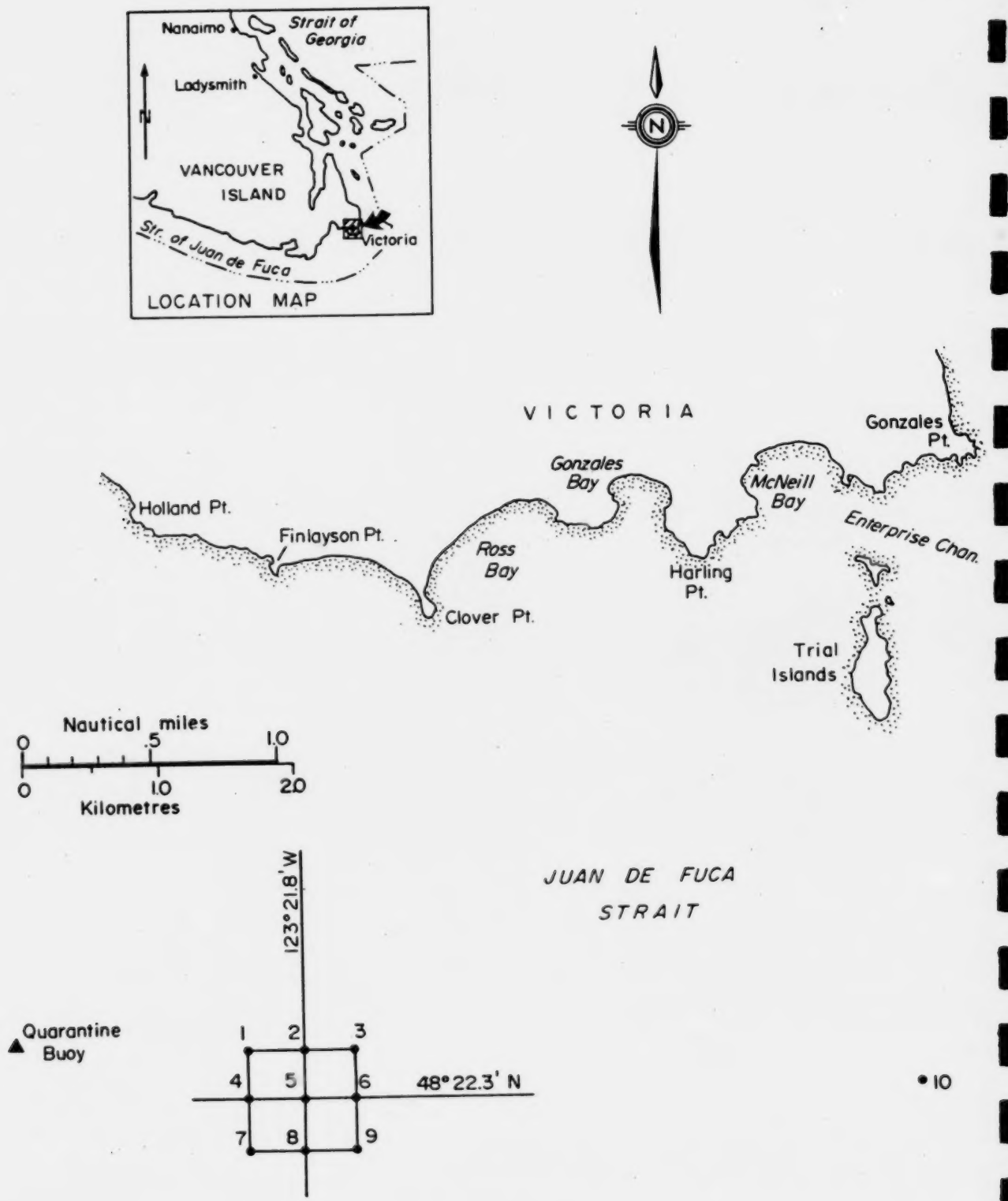


Figure 5. Victoria disposal site sediment sampling stations.

5.4 PORLIER PASS

Disposal Site:	Porlier Pass
Number:	32
Co-ordinates:	49°00.20'N; 123°29.80'W
Depth:	200 metres
Total Quantity Disposed Since 1976:	149 935 cubic metres

Comments

The DFO Habitat Management Unit in Nanaimo (South Coast Division) should be contacted for specific timing restrictions for dredging and disposal.

Loadsite Information

Maintenance dredging activities for forest industries in Chemainus and Ladysmith were responsible for 4 500 cubic metres of material sent to Porlier Pass disposal site in 1996.

5.5 FIVE FINGER ISLAND

Disposal Site:	Five Finger Island
Number:	40
Co-ordinates:	49°15.20'N; 123°54.60'W
Depth:	280 metres
Total Quantity Disposed Since 1976:	202 712 cubic metres

Comments

For dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Nanaimo.

Loadsite Information

In 1996, 3 900 cubic meters of material resulting from forest related industries in Ladysmith and Duke Point was sent to the Five Finger Island disposal site.

5.6 COMOX (CAPE LAZO)

Disposal Site:	Comox (Cape Lazo)
Number:	48
Co-ordinates:	49°41.70'N; 124°44.50'W
Depth:	190 metres
Total Quantity Disposed Since 1976:	16 117 cubic metres

Comments

For specific dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Nanaimo.

Loadsite Information

Maintenance dredging activities in Courtenay River contributed to 4 000 cubic meters of material sent to Comox disposal site in 1996.

5.7 MALASPINA STRAIT

Disposal Site:	Malaspina Strait
Number:	49
Co-ordinates:	49°45.00'; 124°27.00'W
Depth:	320 metres
Total Quantity Disposed Since 1976:	391 600 cubic metres

Comments

For dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Nanaimo.

Loadsite Information

In 1996, over 25 500 cubic meters of dredge material from the MacMillan Bloedel operations in Powell River was sent to the Malaspina Strait disposal site.

Monitoring Information

In October 1996, surface sediment samples were collected from nine stations at the Malaspina Strait disposal site and from four reference stations off the disposal site. These samples were analysed for trace metals, particle size and total PAH. Chemical analyses are presented in Table 7.

All sediment collected from in and around the disposal site contained cadmium in excess of the ICTG screening limit. Past monitoring in this area (Kim and Sullivan, 1993), (Sullivan, 1987) have shown this area to be one with naturally occurring elevated cadmium concentrations. Samples from stations 6 and 8 contained total PAH concentrations above the ICTG limit.

To determine the toxicity of sediments from Malaspina Strait disposal site, two bioassay tests were conducted on test sediments: the 10-day acute toxicity test using the amphipod *E. washingtonianus* and the solid-phase Microtox® pore water toxicity test. Biological test results are presented in Table 8.

Amphipod survival was compared with the results of Reference Station 10 to determine toxicity of the sediment. Toxic responses were observed in sediment from three stations at the disposal site and in sediment from two of the reference stations. Three of the samples from the disposal site failed the Microtox® test.

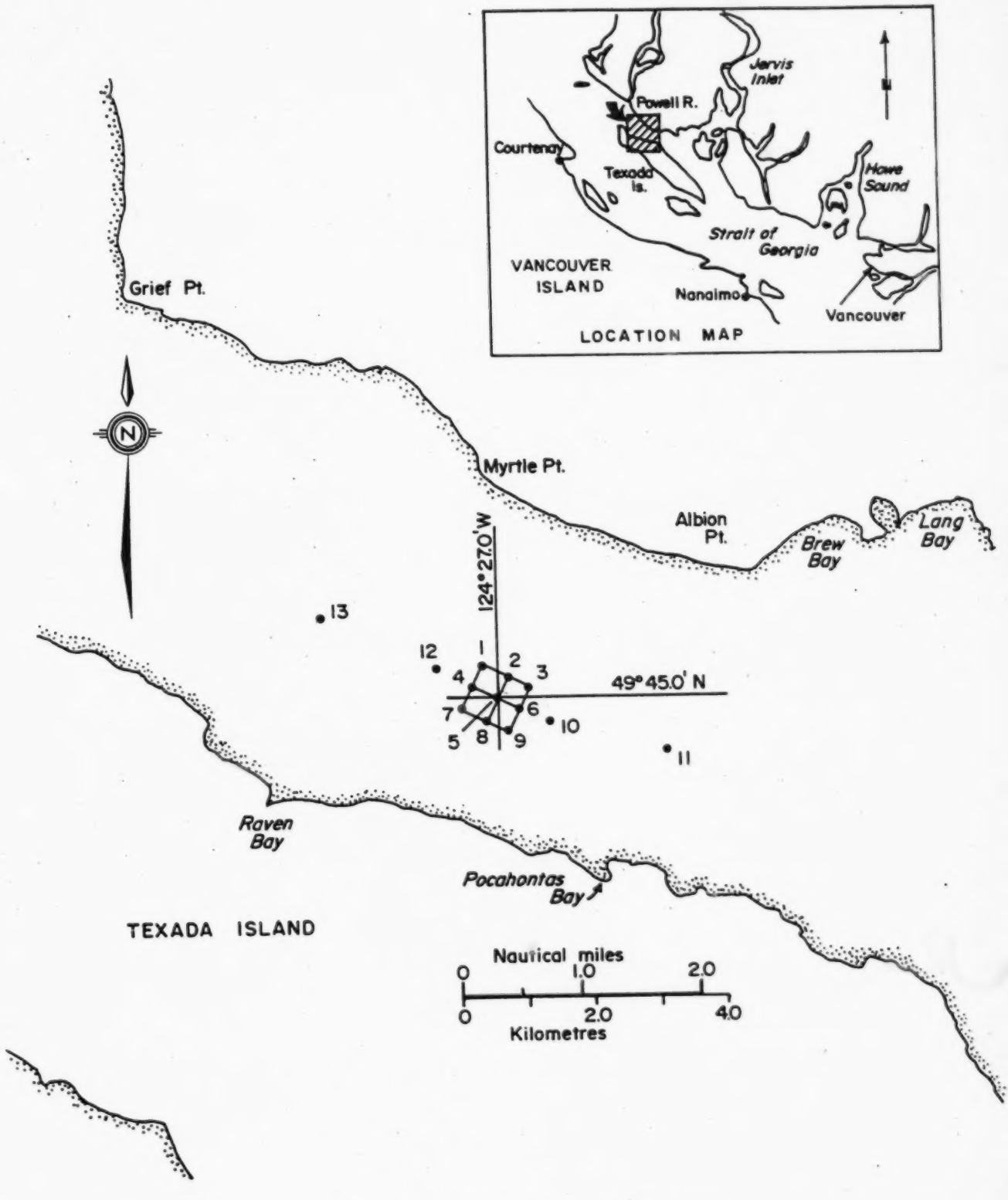


Figure 6. Malaspina Strait disposal site sediment sampling stations.

Table 7. Malaspina Strait sediment chemistry - October 1996 survey.

Station	Sediment Chemistry[5] Cd µg/g	Cu µg/g	Hg µg/g	Pb µg/g	Zn µg/g	Total PAH µg/g	TOC %
1	* 0.78	76.5	0.141	39	184	1.88	5.03
2	* 0.71	73.7	0.139	41	167	1.98	5.10
3	* 0.77	80.0	0.152	46	176	2.36	3.90
4	* 0.67	71.4	0.126	38	144	2.42	8.29
5	* 0.65	71.9	0.129	44	171	2.32	10.8
6	* 0.73	67.1	0.126	40	152	* 6.57	11.7
7	* 0.79	70.2	0.114	36	144	1.76	11.5
8	* 0.78	76.3	0.121	32	148	* 4.74	10.8
9	* 0.83	77.7	0.121	33	171	2.50	12.9
10	* 0.79	72.6	0.088	29	160	1.17	7.45
11	* 0.71	80.9	0.113	40	201	1.09	2.82
12	* 0.74	74.9	0.118	33	166	2.16	5.35
13	* 0.79	87.6	0.137	41	190	1.58	3.69

* Indicates concentration above ICTG limits.
Mean values reported for stations 1-9; N = 3.

Table 8. Malaspina Strait biological test results and particle size - October 1996.

Station	Amphipod *E. washingtonianus* % survival	Microtox Solid Phase IC50 % Effect	Particle Size (%) Gravel > 2.0 mm	Sand 2 - 0.063 mm	Silt 0.063 - 0.004 mm	Clay < 0.004 mm
1	* 42.0 ± 12	0.110	11.6	6.8	16.0	65.6
2	* 41.0 ± 16	0.140	17.5	10.5	14.5	57.5
3	* 49.0 ± 11	0.110	10.9	4.4	15.8	68.9
4	74.0 ± 9.6	* 0.088	7.0	13.9	16.1	63.0
5	73.0 ± 10	0.100	15.6	9.9	15.1	59.4
6	63.0 ± 10	* 0.054	18.7	9.7	14.8	56.8
7	82.0 ± 5.7	* 0.089	20.0	10.8	14.7	54.4
8	76.0 ± 6.5	0.120	18.7	11.4	15.1	54.9
9	79.0 ± 4.2	0.120	13.4	11.5	15.6	59.5
10	81.0 ± 7.4	0.160	7.1	7.2	17.1	68.6
11	* 59.0 ± 12	0.220	0.4	1.5	18.0	80.1
12	75.0 ± 13	0.270	6.1	7.4	18.1	68.4
13	* 50.0 ± 14	0.150	0.0	1.6	18.1	80.3
Control	90.0 ± 3.5			Not Available		

* Indicates toxic response observed.
Samples were compared to Station 10 for determining toxicity in amphipods; mean values reported, N = 5.

[5] Trace metal analyses are presented as total metals

5.8 THORNBROUGH CHANNEL

Disposal Site: Thornbrough Channel
Number: 64
Co-ordinates: 49°31.00'N; 123°28.30'W
Depth: 220 metres
Total Quantity Disposed Since 1976: 66 861 cubic metres

Comments

Clamshell dredging is prohibited in water which is less than 5 meters deep at daily low water between March 01 and August 15. For complete dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in New Westminster.

Loadsite Information

In 1996, 8 000 cubic meters of dredge material from Howe Sound was disposed of at the Thornbrough Channel disposal site.

Monitoring Information

Sediment samples were collected at nine stations at the Thornbrough Channel disposal site in April 1996. Analyses included trace metals, particle size, total PAH and TOC. There were no concentrations found that exceeded the ICTG limits.

Table 9. Thornbrough Channel sediment chemistry and particle size - April 1996 survey.

Station	Sediment Chemistry[6]					Particle Size (%)			
	Cd	Pb	Hg	TPAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	%	> 2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	<0.004 mm
1	0.56	16	0.073	2.09	3.80	2.4	56.7	23.7	17.2
2	0.53	17	0.089	2.34	4.90	6.9	47.0	24.3	21.8
3	0.36	13	0.163	0.67	3.22	11.7	47.1	21.7	19.5
4	0.54	21	0.142	2.02	3.92	0.9	39.5	28.0	31.6
5	0.51	19	0.135	1.28	4.45	2.4	33.4	29.6	34.6
6	0.50	19	0.129	1.50	3.76	10.7	20.7	28.9	39.7
7	0.47	17	0.144	1.38	5.37	12.5	17.4	30.2	39.9
8	0.50	18	0.141	1.13	5.23	2.0	22.2	32.2	43.6
9	0.51	17	0.152	1.33	10.0	10.4	11.3	30.9	47.4

[6] Trace metal analyses are presented as total metals.

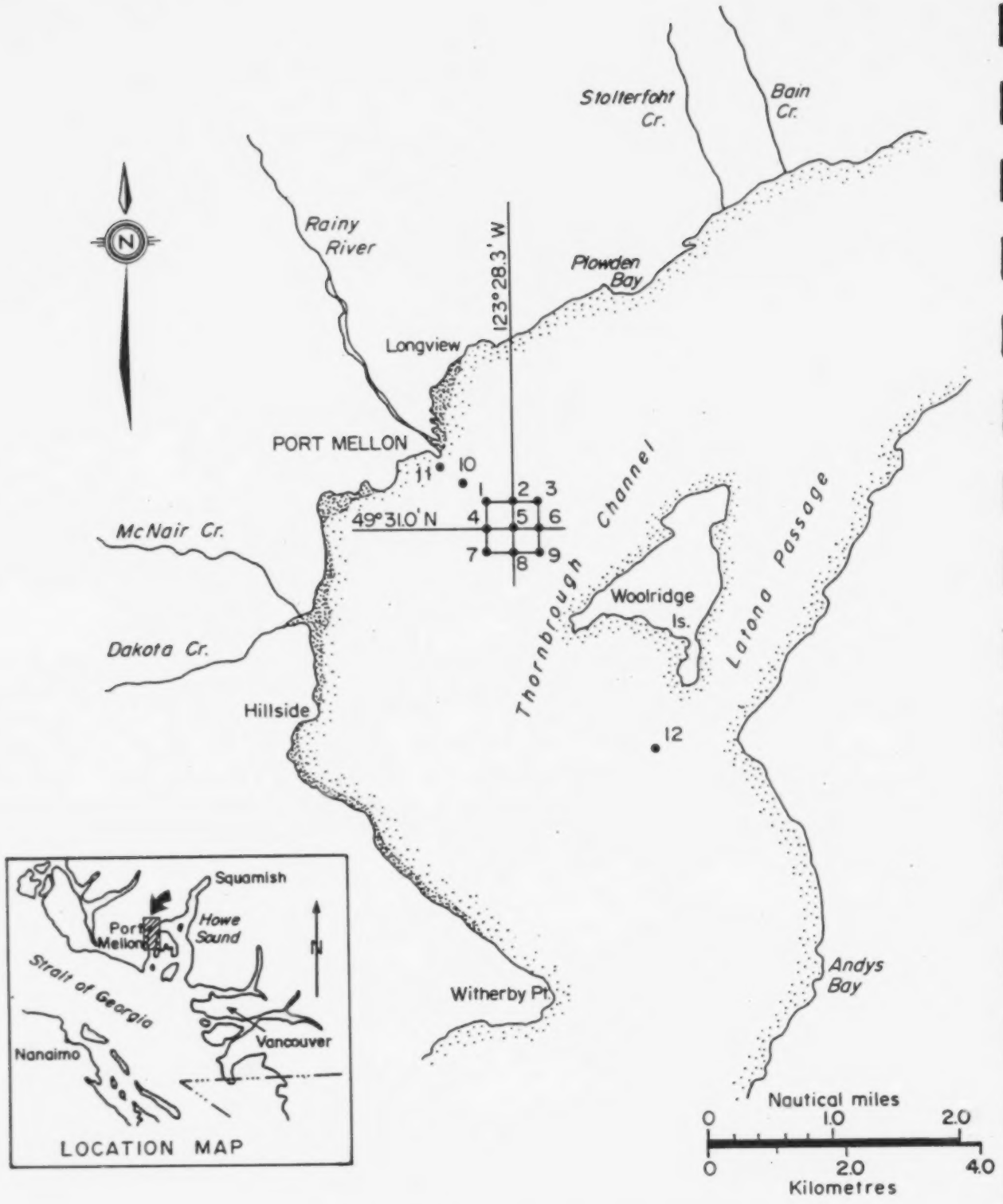


Figure 7. Thornbrough Channel disposal site sediment sampling stations.

5.9 WATTS POINT

Disposal Site: Watts Point
Number: 65
Co-ordinates: 49°38.50'N; 123°14.00'W
Depth: 230 metres
Total Quantity Disposed Since 1976: 477 016 cubic metres

Comments

Dredging is prohibited from April 01 to June 01 of any year in order to protect juvenile salmonids migrating downstream in Mill Creek. For further dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in New Westminster.

Loadsite Information

There was no material sent to the Watts Point disposal site in 1996.

Monitoring Information

Surface sediment grabs were collected at nine stations at the Watts Point disposal site in April 1996. Chemical analyses included trace metals, particle size, total PAH and TOC. There were no concentrations found that exceeded the ICTG limits.

Table 10. Watts Point sediment chemistry and particle size - April 1996 survey.

Station	Sediment Chemistry[7]					Particle Size (%)			
	Cd	Pb	Hg	TPAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	%	>2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	<0.004 mm
1	0.10	7	0.032	0.09	0.73	0.5	3.5	67.8	28.2
2	0.18	7	0.032	0.07	0.76	0.1	2.0	74.0	23.9
3	0.20	8	0.030	0.13	0.61	0.1	3.6	72.7	23.6
4	0.10	7	0.027	0.08	0.58	0.0	1.9	69.2	28.9
5	0.10	8	0.024	0.09	0.59	4.1	8.7	63.4	23.8
6	0.10	8	0.028	0.08	0.76	0.0	4.3	72.1	23.6
7	0.10	9	0.050	0.23	0.61	4.1	5.1	51.8	39.0
8	0.10	8	0.034	0.18	0.69	3.9	6.9	54.7	34.5
9	0.20	7	0.035	0.09	0.55	0.0	2.8	66.5	30.7

[7] Trace metal analyses are presented as total metals.

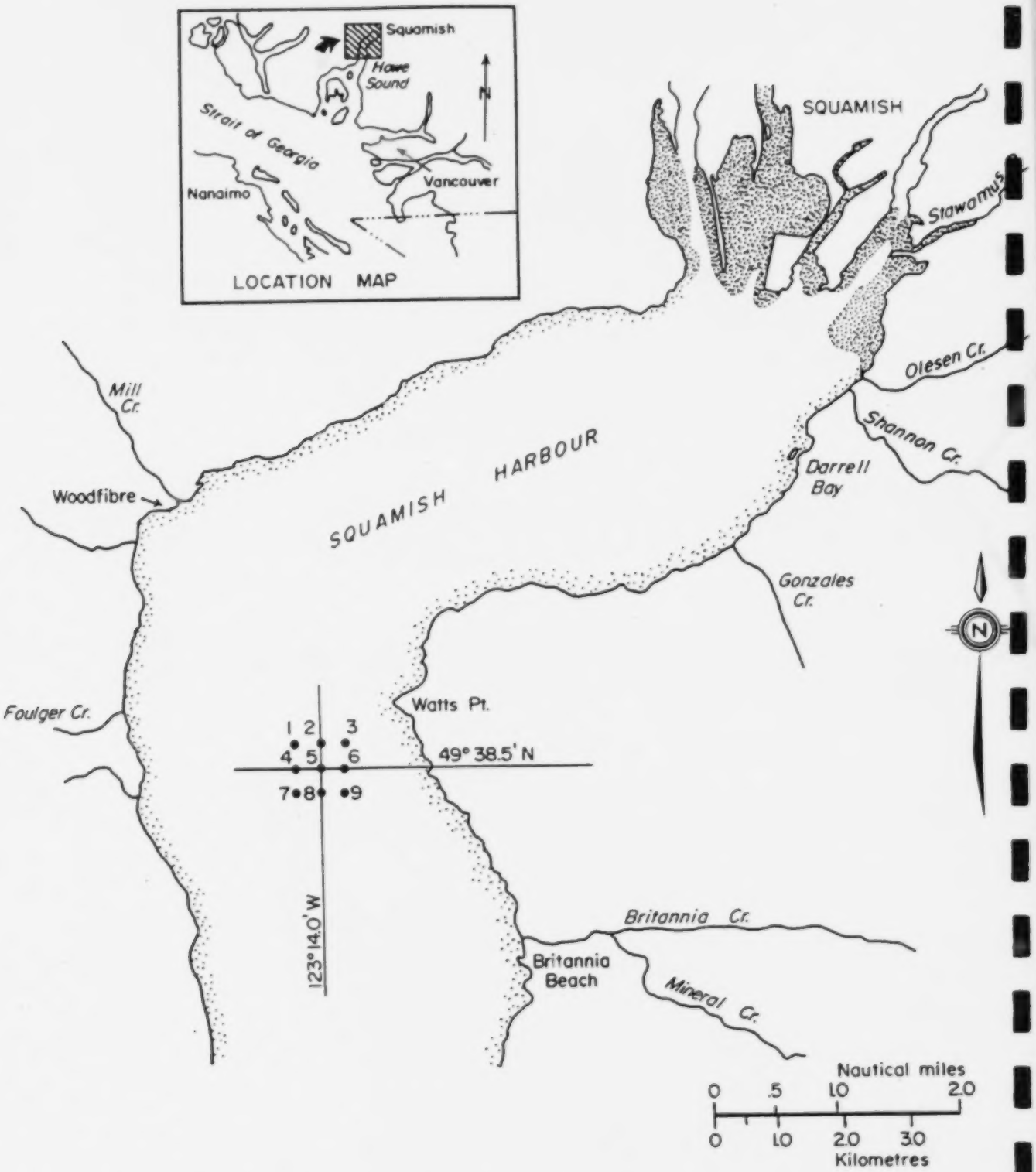


Figure 8. Watts Point disposal site sediment sampling stations.

5.10 TAHSIS INLET

Disposal Site:	Tahsis Inlet
Number:	83
Co-ordinates:	49°51.60'N; 126°39.60'W
Depth:	200 metres
Total Quantity Disposed Since 1976:	167 119 cubic metres

Comments

DFO generally prohibits dredging/loading and ocean disposal of woodwastes from March 1 to July 14 and from August 16 to November 30 at the Tahsis Inlet disposal site.

Loadsite Information

No material has been sent to the Tahsis Inlet disposal site since 1989.

Monitoring Information

Surface sediment grabs were collected from three stations at the Tahsis Inlet disposal site and from one reference station off the disposal site. Samples were analysed for trace metals, particle size, total PAH and TOC. PAH and TOC analyses were conducted on sediment from the reference station and on a composite sample with sediment from stations 4, 5 and 6.

All samples contained cadmium concentrations that exceeded the ICTG limits. Past monitoring at this disposal site (Sullivan, 1987) showed cadmium concentrations in the sediments exceeded the ICTG concentrations.

Table 11. Tahsis Inlet sediment chemistry and particle size - June 1996 survey.

Station	Sediment Chemistry[1]							Particle Size (%)			
	Cd µg/g	Hg µg/g	Pb µg/g	Cu µg/g	Zn µg/g	TPAH µg/g	TOC %	Gravel > 2.0 mm	Sand 2 - 0.063 mm	Silt 0.063 - 0.004 mm	Clay < 0.004 mm
4	* 0.81	0.108	19	67.3	75.6			13.1	16.1	29.3	41.5
5	* 0.76	0.109	18	59.9	77.4	♦0.92	♦4.39	0.7	6.5	37.8	55.0
6	* 0.70	0.112	22	62.0	82.1			34.2	15.1	24.8	25.9
Reference (11)	* 0.83	0.134	20	54.7	83.2	1.17	4.7	6.7	10.1	28.6	54.6

* Indicates concentration above ICTG limits.
♦ Sample is a composite of sediment from stations 4, 5 and 6.

[1] Trace metal analyses are presented as total metals.

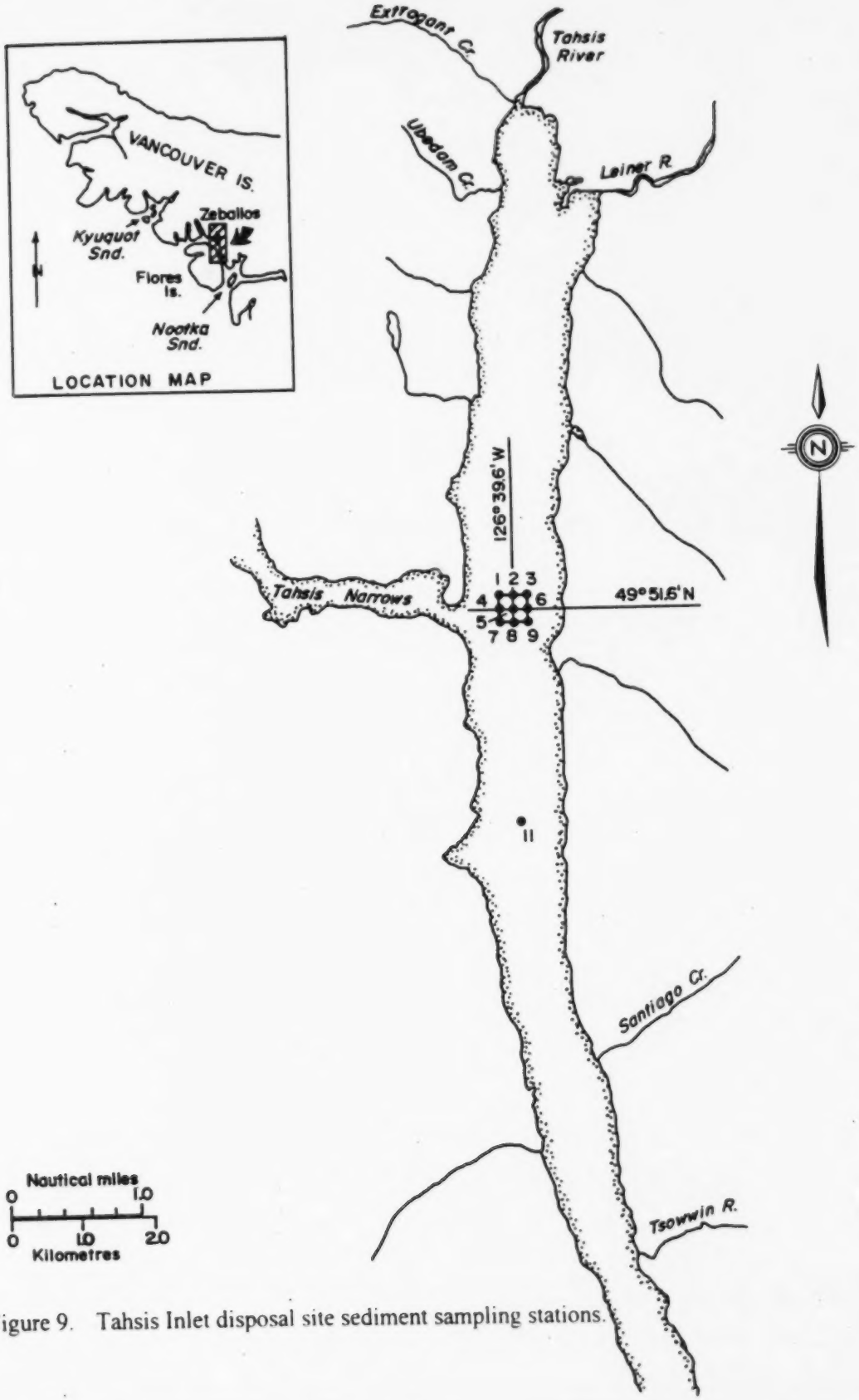


Figure 9. Tahsis Inlet disposal site sediment sampling stations.

5.11 NEWCOMBE CHANNEL

Disposal Site: Newcombe Channel
Number: 86
Co-ordinates: 48°54.70'N; 125°29.30'W
Depth: 50 metres
Total Quantity Disposed Since 1976: 62 710 cubic metres

Comments

DFO generally restricts ocean disposal and dredging/loading during the periods July 15 to August 15 and November 15 to February 15 to protect rearing and spawning salmon and herring populations.

Loadsite Information

No ocean disposal has been approved at the Newcombe Channel disposal site since 1988.

Monitoring Information

Surface sediment samples were collected from nine stations at the disposal site and one reference station off the disposal site in June 1996. Samples were analysed for trace metals, particle size, total PAH and TOC. Data are presented in Table 11. No concentrations were found to exceed the ICTG limits with the exception of cadmium at the reference station.

Table 12. Newcombe Channel sediment chemistry and particle size - June 1996 survey.

Station	Sediment Chemistry[9]					Particle Size (%)			
	Cd µg/g	Hg µg/g	Pb µg/g	Cu µg/g	Zn µg/g	Gravel > 2.0 mm	Sand 2 - 0.063 mm	Silt 0.063 - 0.004 mm	Clay < 0.004 mm
1	0.45	0.055	< 8	24.0	53	1.5	61.4	20.9	16.2
2	0.39	0.048	< 8	22.0	46	0.8	64.9	19.3	15
3	0.37	0.057	< 8	23.1	46		Not Available		
4	0.51	0.074	< 8	29.4	56	1.2	39.6	34.9	24.3
5	0.57	0.071	< 8	30.5	65	4.3	36.0	34.7	25.0
6	0.55	0.072	20	28.7	64	6.8	41.3	27.3	24.6
7	0.21	0.019	< 8	27.4	23	16.5	83.5	0.0	0.0
8	0.30	0.068	10	25.1	52	2.0	65.0	15.4	17.6
9	0.39	0.051	10	26.7	56	2.2	55.5	20.5	21.8
Reference (10)	*0.75	0.079	9	38.9	102	4.9	14.7	35.1	45.3

* Indicates concentration above ICTG limit.

[9] Trace metal analyses are presented as total metals.

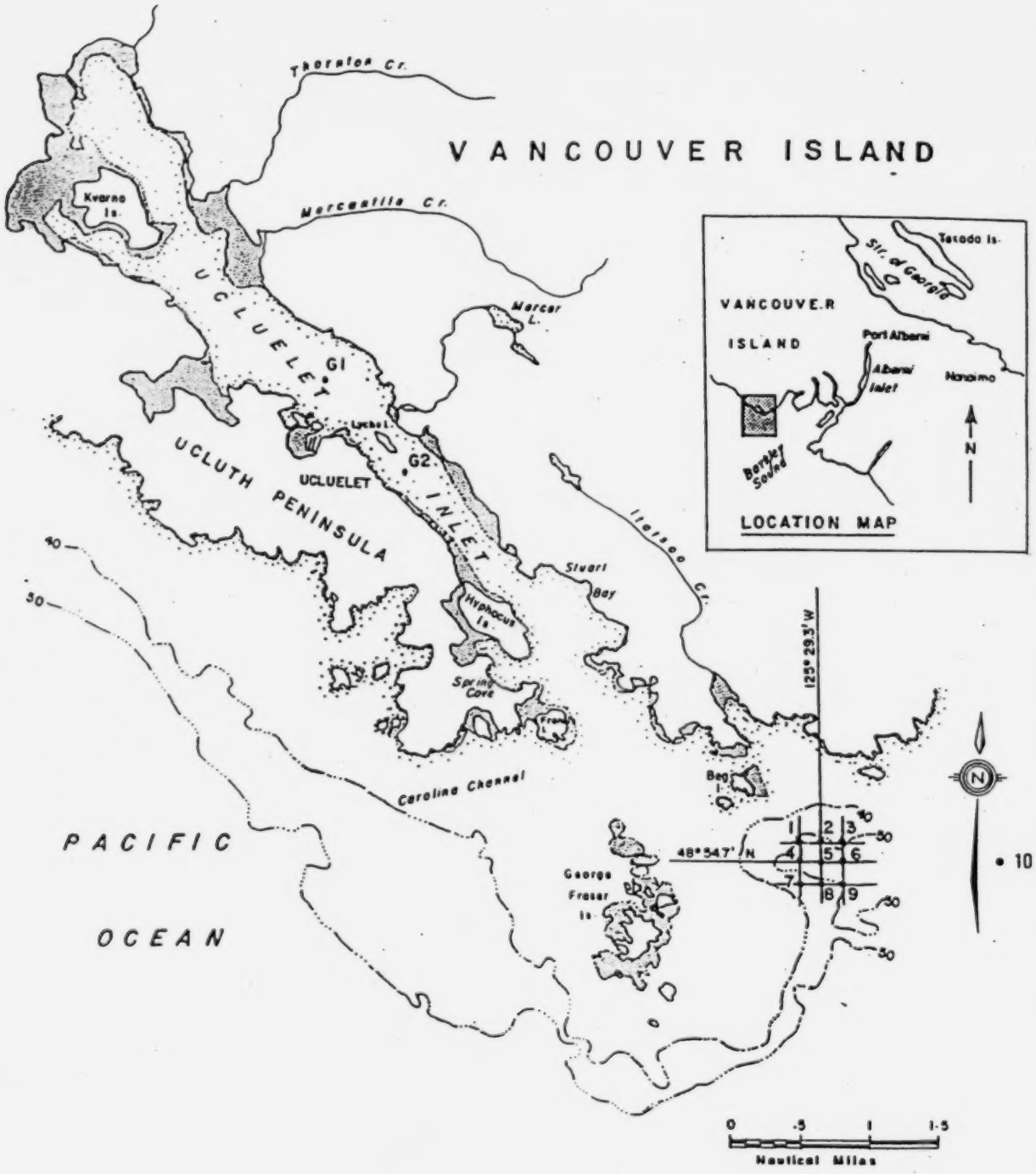


Figure 10. Newcombe Channel disposal site sediment sampling stations.

5.12 PORT ALBERNI

Disposal Site: Port Alberni
Number: 88
Co-ordinates: 49°11.80'N; 124°49.30'W
Depth: 45 metres
Total Quantity Disposed Since 1976: 877 118 cubic metres

Comments

In April 1992, RODAC advised closure of the Port Alberni disposal site to the disposal of woodwastes and organic-rich sediments due to the impact on the dissolved oxygen regime and to protect fisheries resources in the inlet. For dredging and disposal timing restrictions, contact the local DFO Habitat Management Unit.

Loadsite Information

In 1996, 400 cubic meters of dredge material from the China Creek Marina was sent to the Port Alberni disposal site.

Monitoring Information

In June 1996, sediment samples were collected from eleven stations at the Port Alberni disposal site. Data are presented in Table 12. Cadmium concentrations in sediment from six of the stations exceeded the ICTG criteria, as did TPAH concentration at Station 19.

Table 13. Port Alberni sediment chemistry and particle size - June 1996 survey.

	Sediment Chemistry[10]							Particle Size (%)			
Station	Cd µg/g	Hg µg/g	Pb µg/g	Cu µg/g	Zn µg/g	TPAH µg/g	TOC %	Gravel > 2.0 mm	Sand 2 - 0.063 mm	Silt 0.063 - 0.004 mm	Clay < 0.004 mm
18	* 0.65	0.252	16	99.4	130	1.47	5.06	0.1	15.2	45.7	39.0
19	* 1.40	0.330	21	73.7	248	* 5.02	5.50	9.0	25.1	43.9	22.0
20	0.55	0.133	23	71.8	115	0.86	6.40	17.4	51.1	19.2	12.3
21	0.39	0.113	20	56.4	100	0.92	3.30	7.0	70.9	13.5	8.6
22	0.20	0.064	10	46.9	72	0.09	0.49	40.8	54.1	2.9	2.2
23	0.47	0.076	10	58.4	89	0.13	1.56	52.1	33.0	9.9	5.0
24	* 0.78	0.256	17	102	145	2.08	4.89	0.5	9.3	51.7	38.5
25	0.34	0.165	15	98.3	97	0.87	4.33	0.4	25.7	44.4	29.5
26	* 0.81	0.201	19	73.6	125	1.18	3.99	0.0	1.2	36.8	62.0
27	* 0.62	0.121	23	50.8	108	1.17	2.59	0.0	0.7	26.1	73.2
28	* 0.61	0.117	22	41.5	94	0.66	2.24	0.3	1.1	25.3	73.4

* Indicates concentration above ICTG limits.
Mean values reported for stations 18, 24-28; N = 3.

[10] Trace metal analyses are presented as total metals.

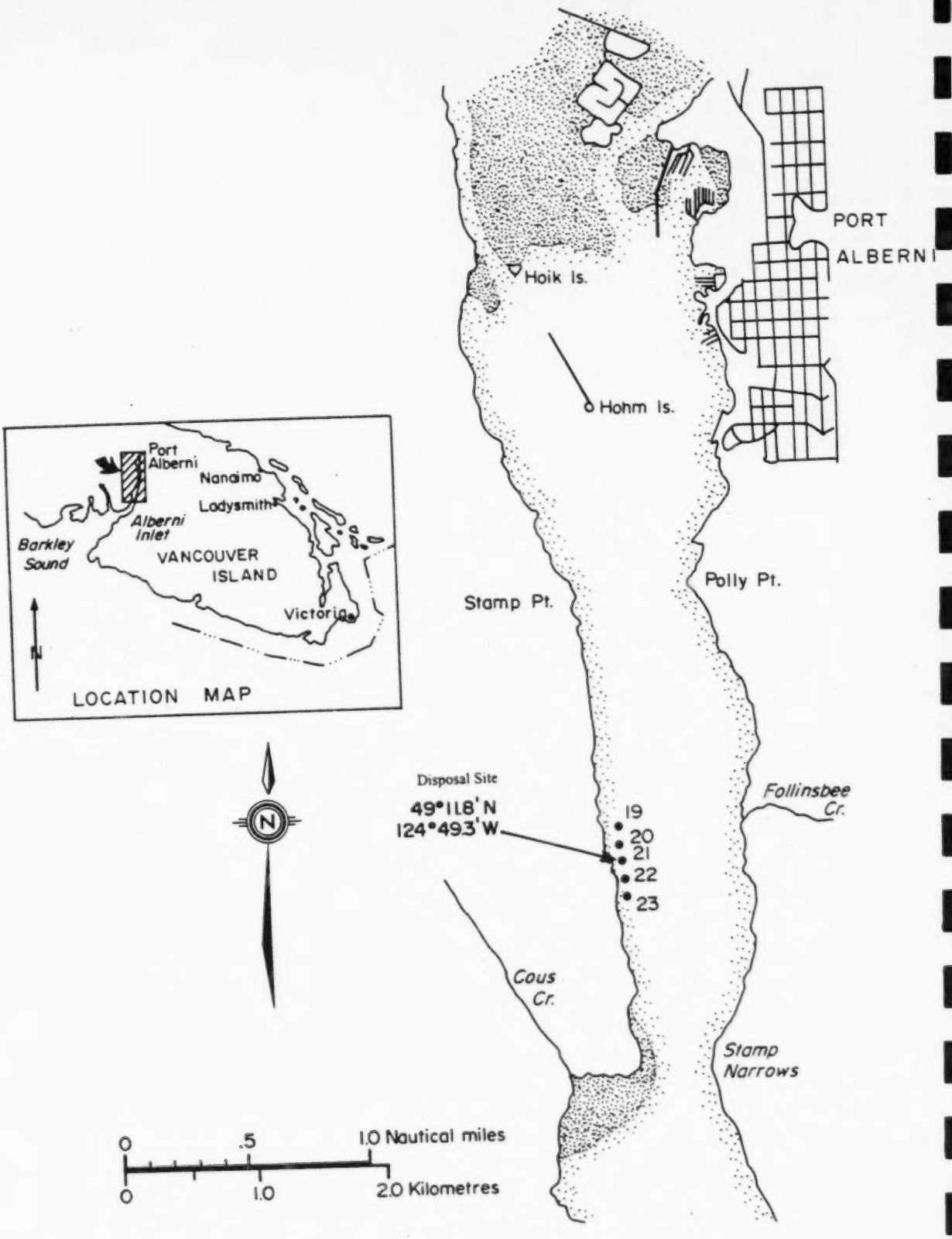


Figure 11. Port Alberni disposal site sediment sampling stations.

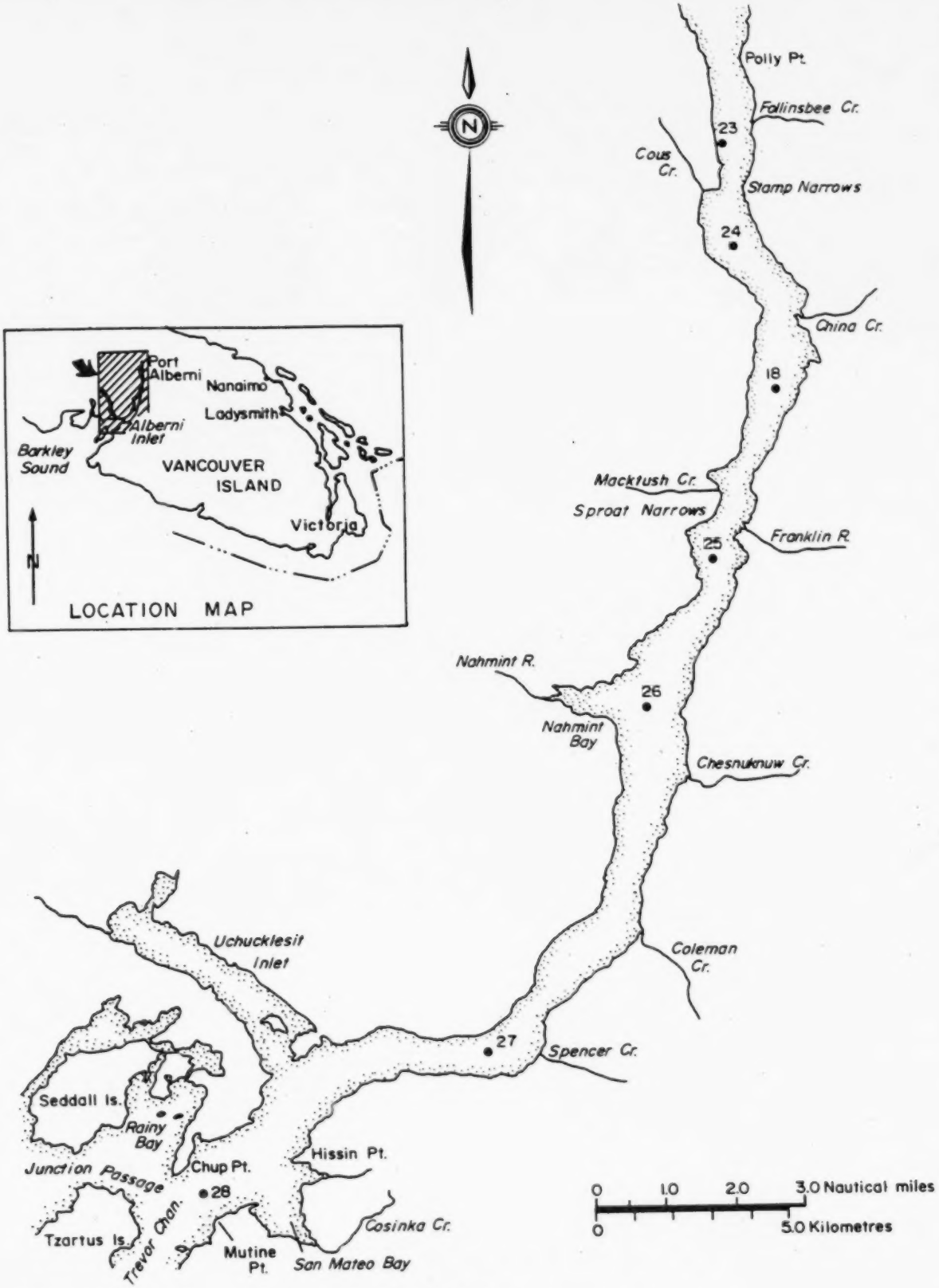


Figure 12. Port Alberni disposal site reference stations.

5.13 KITIMAT ARM

Disposal Site:	Kitimat Arm
Number:	93
Co-ordinates:	53°58.00'N; 128°41.50'W
Depth:	176 metres
Total Quantity Disposed Since 1976:	63 555 cubic metres

Comments

For dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Prince Rupert.

Loadsite Information

In 1996, approximately 100 cubic meters of non-recyclable, concrete filled, turning dolphins were disposed of at the Kitimat Arm disposal site. The material originated from the Eurocan Pulp Mill in Kitimat.

5.14 BROWN PASSAGE

Disposal Site:	Brown Passage
Number:	100
Co-ordinates:	54°18.70'N; 130°45.00'W
Depth:	180 metres
Total Quantity Disposed Since 1976:	295 393 cubic metres + 563 tonnes

Comments

Contact the DFO Habitat Management Unit in Prince Rupert for dredging and disposal timing restrictions.

Loadsite Information

In 1996, a steel, flat-decked scow was disposed of at the Brown Passage disposal site. Prior to disposal, the scow was inspected and determined to be free of hydrocarbons

5.15 CAPE MUDGE

Disposal Site: Cape Mudge
Number: 116
Co-ordinates: 49°57.70'N; 125°05.00'W
Depth: 200 metres
Total Quantity Disposed Since 1976: 145 853 cubic metres

Comments

DFO generally prohibits dredging/loading activities during the period December 1 to March 15 in the Campbell River area to protect salmon stocks and to minimize disruption of the local sport fishery.

For specific dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Nanaimo.

Loadsite Information

This disposal site was not used in 1996.

Monitoring Information

In October, 1996 a benthic sediment survey was conducted at the Cape Mudge disposal site. Sediment from nine stations and a reference station was collected and analysed for trace metals and particle size. Data are presented in Table 12. TPAH concentrations exceeded the ICTG limits at all stations within the disposal site.

Table 14. Cape Mudge sediment chemistry and particle size - October 1996 survey.

	Sediment Chemistry[11]							Particle Size (%)			
Station	Cd	Cu	Hg	Pb	Zn	TPAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	%	> 2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	< 0.004 mm
1	0.10	23.8	0.029	3	31.6			2.6	82.3	5.3	9.8
2	0.20	41.5	0.050	6	51.5	*3.13	0.71	13.3	61.3	9.7	15.7
3	0.26	56.6	0.074	10	77.9			2.9	48.1	16.9	32.1
4	0.09	27.7	0.029	4	37.9			2.9	81.0	5.6	10.5
5	0.10	38.1	0.039	5	45.1	*3.79	1.39	34.1	53.1	4.4	8.4
6	0.19	55.1	0.074	10	79.3			0.8	50.9	17.9	30.4
7	0.09	31.5	0.039	5	43.2			4.3	75.8	7.0	12.9
8	0.10	40.4	0.047	6	53.1	*2.71	1.17	0.0	77.7	7.3	15.0
9	0.22	58.9	0.074	10	88.0			1.9	50.1	15.7	32.3
Reference (10)	0.10	23.2	0.035	4	39.4	0.10	0.44	11.2	74.6	4.9	9.3

* Indicates concentration above ICTG limit.
TPAH and TOC results for stations 1-9 are composites of grabs taken at three stations.

[11] Trace metal analyses are presented as total metals.

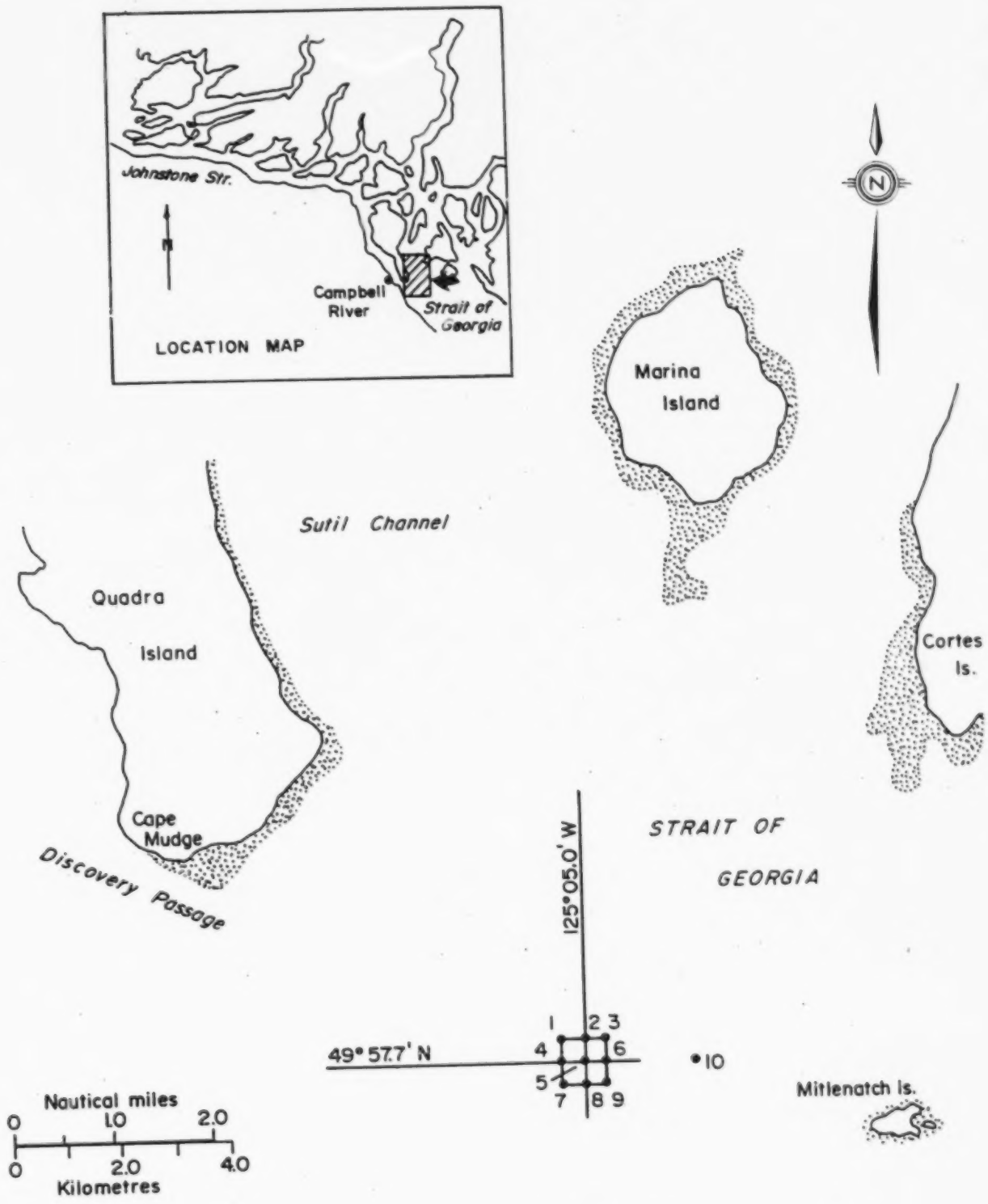


Figure 13. Cape Mudge disposal site sediment sampling stations.

5.16 MUCHALAT INLET

Disposal Site: Muchalat Inlet
Number: 117
Co-ordinates: 49°39.00'N; 126°14.90'W
Depth: 370 metres
Total Quantity Disposed Since 1976: 181 108 cubic metres

Comments

DFO timing restrictions prohibit the disposal of woodwastes from the period March 1 to July 14 and from August 16 to November 30.

For specific dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Nanaimo.

Loadsite Information

No material has been sent to the Muchalat Inlet disposal site since 1990.

Monitoring Information

A benthic sediment survey was conducted at this disposal site in June 1996. Grab samples were collected at three stations within disposal site boundaries and at one reference site. Previous monitoring at this disposal site (Sullivan, 1987) indicates that high cadmium concentrations are naturally occurring in this area.

Table 15. Muchalat Inlet sediment chemistry and particle size - June 1996 survey.

Station	Sediment Chemistry[12]							Particle Size (%)			
	Cd	Hg	Pb	Cu	Zn	TPAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	%	> 2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	< 0.004 mm
4	0.38	0.020	10	62.0	43.3			42.9	47.7	4.4	5.0
5	* 1.92	0.098	10	71.4	72.3	♦0.43	♦3.43	4.1	16.9	34.8	44.2
6	* 2.04	0.078	18	66.5	69.8			18.2	47.0	14.6	20.2
Reference (11)	* 1.40	0.131	10	54.8	96.8	1.65	3.75	2.1	2.9	33.4	61.6

* Indicates concentration above ICTG limit.
♦ Sample is a composite of sediment from stations 4, 5 and 6.

[12] Trace metal analyses are presented as total metals.

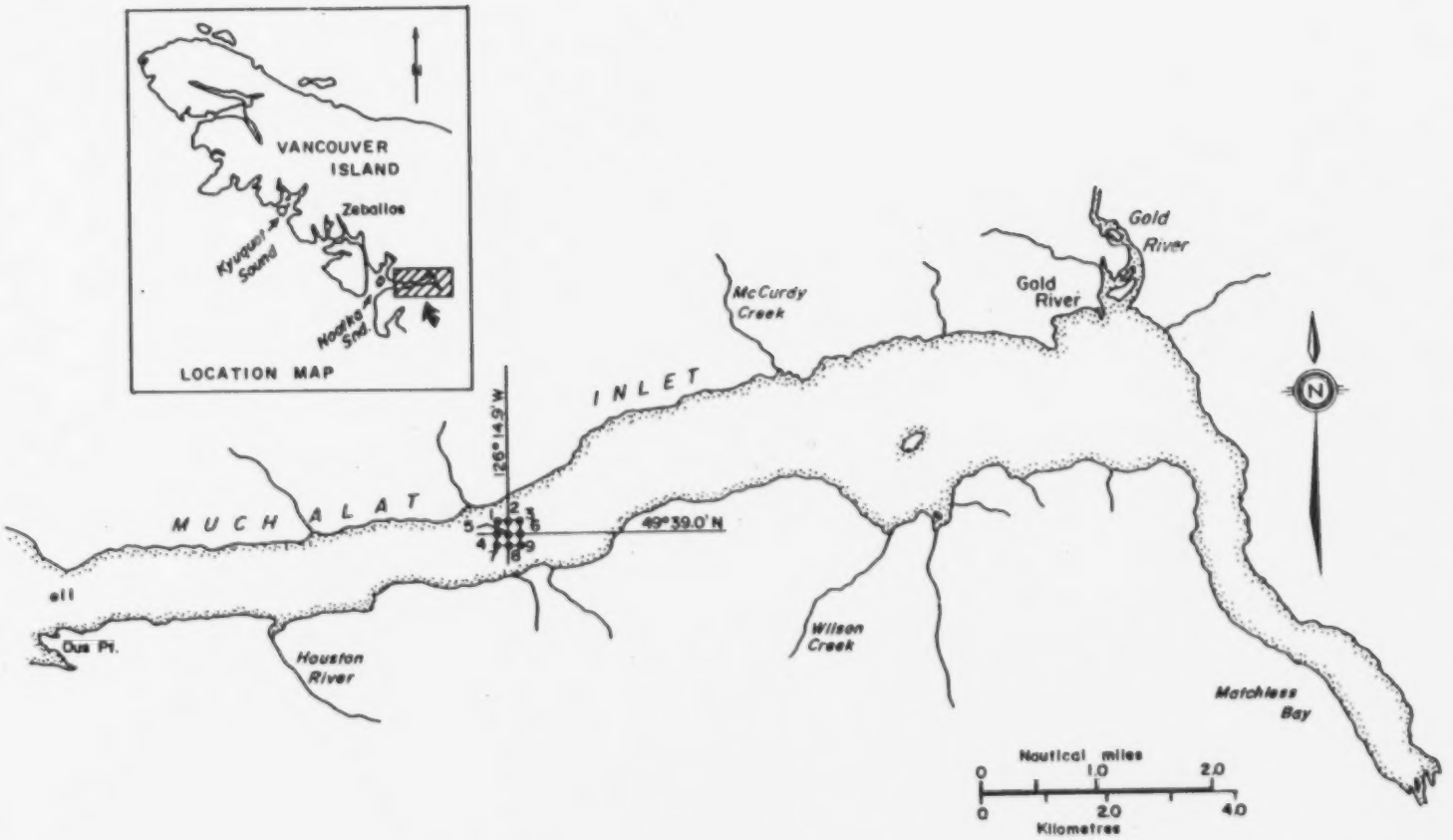


Figure 14. Muchalat Inlet disposal site sediment sampling stations.

5.17 ELIZA PASSAGE

Disposal Site: Eliza Passage
Number: 118
Co-ordinates: 49°40.80'N; 126°34.30'W
Depth: 200 metres
Total Quantity Disposed Since 1976: 5 430 cubic metres

Comments

Loading and disposal activities will be restricted to periods which will not impose a threat to biological resources. These periods are specified by the local DFO Habitat Management Unit.

Loadsite Information

This disposal site has not been used since 1986.

Monitoring Information

Sediment samples were collected from three stations at this disposal site and from one reference station in June 1996. Cadmium concentrations at all stations exceeded the ICTG limit. Previous monitoring surveys at this disposal site have also found cadmium concentrations above the screening limits (Sullivan, 1987).

Table 16. Eliza Passage sediment chemistry and particle size - June 1996 survey.

	Sediment Chemistry[13]							Particle Size (%)			
Station	Cd	Hg	Pb	Cu	Zn	TPAH	TOC	Gravel	Sand	Silt	Clay
	µg/g	µg/g	µg/g	µg/g	µg/g	µg/g	%	> 2.0 mm	2 - 0.063 mm	0.063 - 0.004 mm	< 0.004 mm
4	* 0.78	0.099	20	42.9	78.2			0.9	1.2	33.6	64.3
5	* 0.89	0.096	20	44.0	80.6	♦0.70	♦3.64	0.3	0.7	33.6	65.4
6	* 0.75	0.093	20	43.2	80.0			0.4	0.7	33.5	65.4
Reference (10)	* 0.86	0.101	20	40.5	75.1	0.96	3.10	0.0	0.7	28.0	71.3

* Indicates concentration above ICTG limits.
♦ Sample is a composite of grabs at stations 4, 5 and 6.

[13] Trace metal analyses are presented as total metals.

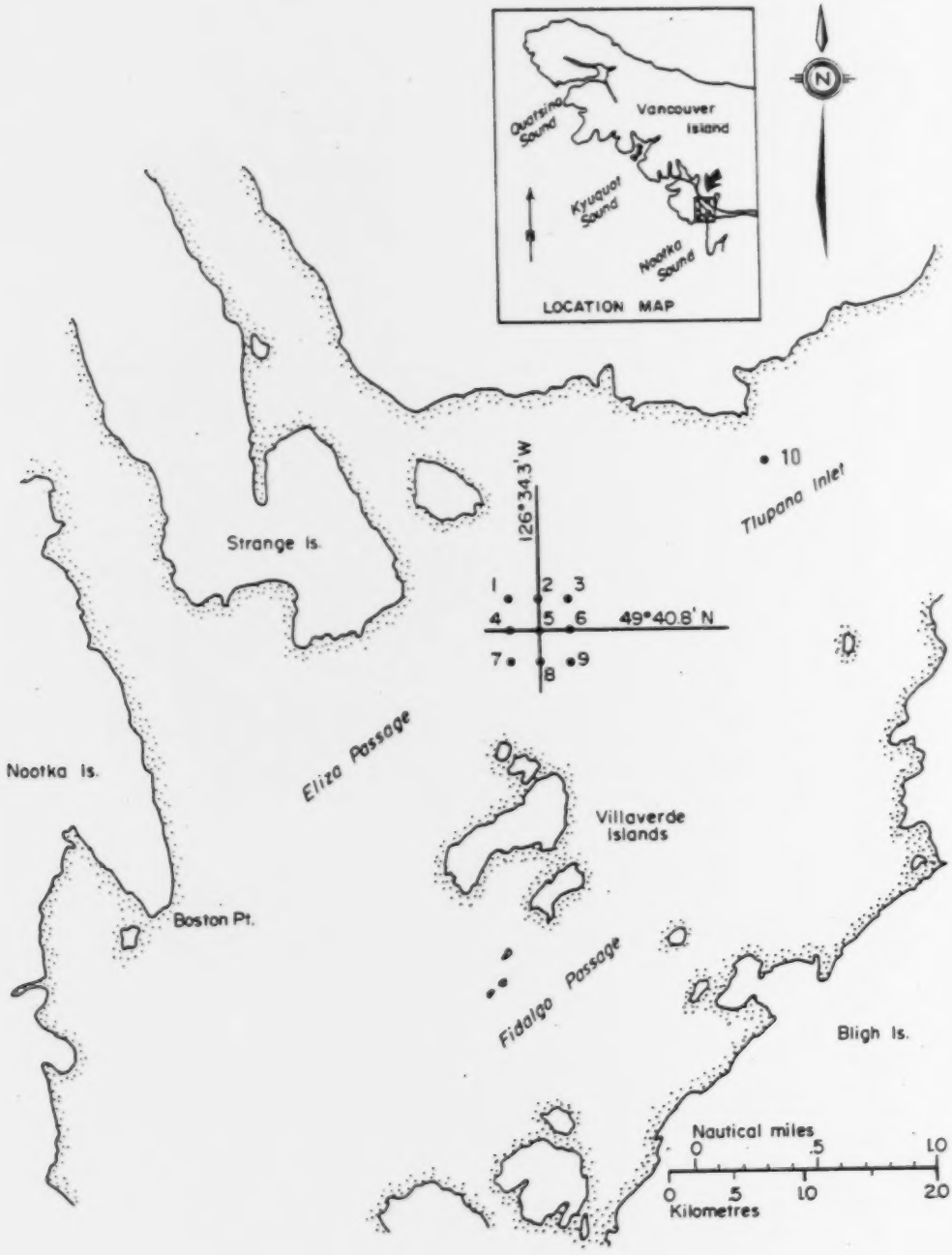


Figure 15. Eliza Passage disposal site sediment sampling stations.

5.18 JOHNSTONE STRAIT - HICKEY POINT

Disposal Site:	Johnstone Strait - Hickey Point
Number:	119
Co-ordinates:	50°27.80'N; 126°04.80'W
Depth:	270 metres
Total Quantity Disposed Since 1976:	154 188 cubic metres

Comments

DFO generally requests that dredging/loading activities be scheduled during the period November 1 to February 28 to protect fishery resources and minimize interference with recreational fishing.

For specific dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Nanaimo.

Loadsite Information

In 1996, 3 600 cubic meters of dredge material was sent to the disposal site from MacMillan Bloedel operations in Kelsey Bay.

5.19 JOHNSTONE STRAIT - HANSON ISLAND

Disposal site:	Johnstone Strait - Hanson Island
Number:	120
Co-ordinates:	50°33.50'N; 126°48.00'W
Depth:	350 metres
Total Quantity Disposed Since 1976:	176 556 cubic metres

Comments

DFO generally prohibits dredging/loading activities during the period November 1 to February 28 to protect fishery resources and avoid interruption of the local sport fishery.

For specific dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Nanaimo.

Loadsite Information

In 1996, 6 000 cubic meters of dredged material was sent to the Johnstone Strait - Hanson Island disposal site. This material originated from forest related industries in neighbouring Port McNeill, Beaver Cove and Scott Cove.

5.20 SQUAMISH

Disposal Site:	Squamish
Number:	164
Co-ordinates:	49°40.70'N; 123°10.90'W
Depth:	80 metres
Total Quantity Disposed Since 1976:	230 950 cubic metres

Comments

Loading and disposal activities will be restricted to periods which will not impose a threat to biological resources. These periods are specified by the DFO Habitat Management Unit in New Westminster.

Loadsite Information

Maintenance dredging activities in Mamquam Channel resulted in the disposal of 6 450 cubic meters of material at the Squamish disposal site this year.

5.21 SHINGLE BAY, Q.C.I.

Disposal Site:	Shingle Bay, Q.C.I.
Number:	174
Co-ordinates:	53°14.95'N; 131°52.10'W
Depth:	51 metres
Total Quantity Disposed Since 1976:	179 600 cubic metres

Comments

For specific dredging and disposal timing restrictions, contact the DFO Habitat Management Unit in Prince Rupert.

Loadsite Information

This disposal site was established in 1995 to receive material from Sandspit Harbour. The creation of a small craft harbour by Public Works Canada and the Sandspit Harbour Society resulted in the disposal of 179 600 cubic meters of dredged material at this disposal site.

5.22 MAUD ISLAND

Disposal Site:	Maud Island
Number:	178
Co-ordinates:	50°08.00'N; 125°14.80'W
Depth:	32 metres
Total Quantity Disposed Since 1976:	2 400 tonnes

Comments

This disposal site was established for the disposal of a vessel as a SCUBA diving attraction. There have been no other disposal activities at this site.

Loadsite Information

The *Columbia*, a decommissioned naval destroyer, was sunk near Maud Island in June 1996 by the Artificial Reef Society of British Columbia. All floatables, fuel, oil, hydraulic fluids, lubricants and other petroleum-based products were removed from the vessel prior to sinking.

6.0 References

Environment Canada. 1993. Interim monitoring guidelines for ocean disposal. Environment Canada, Conservation and Protection.

Environment Canada. 1994. Guidance document on the collection and preparation of sediments for physiochemical characterization and biological testing. Environment Canada, Conservation and Protection. Report EPS 1/RM/29.

Kim, K. and D.L. Sullivan. 1993. Ocean disposal activities summary from 1987 to 1992 for Pacific and Yukon Region. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 93-01.

Kim, K., D.L. Sullivan, D.E. Brothers and C. Schnider. 1997. Ocean disposal activities summary for Pacific and Yukon Region 1993. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 97-01.

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Sullivan, D. 1987. Compilation and assessment of research, monitoring and dumping information for active dumpsites on the British Columbia and Yukon coasts from 1979 to 1987. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Manuscript Report: 87-02.

Sullivan, D.L., D.E. Brothers, K. Kim and C. Schnider. 1997. Ocean disposal activities summary for Pacific and Yukon Region 1994. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Regional Program Report: 97-02.

Ward, A.B. and D.L. Sullivan. 1980. A review of existing and historical ocean dumpsites in the Pacific Region. Environment Canada, Environmental Protection Service, Pacific Region. Regional Program Report: 80-5.

APPENDICES

APPENDIX I

Interim Contaminant Testing Guidelines for Ocean Disposal Pacific and Yukon Region (1997 March)

INTERIM CONTAMINANT TESTING GUIDELINES FOR OCEAN DISPOSAL PACIFIC AND YUKON REGION (1997 MARCH)

In response to growing concern over the biological implications of contaminants in marine sediments along the Canadian coastline, Environment Canada (EC), Pacific and Yukon Region (P&Y), in consultation with the Regional Ocean Disposal Advisory Committee (RODAC), has developed the following guidelines for sampling, analysis and reporting associated with proposed ocean disposal activities.

Under Schedule III, Part III of the Canadian Environmental Protection Act (CEPA), EC (P&Y) must consider the availability of practical alternative disposal options. To satisfy this requirement the applicant must provide a written record of the decision-making process used in selecting ocean disposal as the alternative of choice for disposal of materials. Disposal at sea is only permitted for materials where it is the environmentally preferable and practical alternative.

To assess the potential for environmental impacts of Ocean Disposal, EC (P&Y) will require chemical analyses to be performed on any material where there is a lack of chemical data, or a reason to believe that contaminants such as selected trace metals or organics are present. The minimum number of samples and the analyses required is specified in the following tables; the number of samples and the analyses required may be increased by EC (P&Y) in some instances. A proposed sampling program should be developed by the applicant, based on information provided in the following tables, and submitted to EC (P&Y) for approval prior to commencement of loading/ocean disposal activities.

Materials found to contain substances of concern at or higher than the regulated or guideline concentrations identified in the following tables may be considered for ocean disposal under section 71(3) of CEPA if they pass a series of biological tests. A tiered assessment approach using biological testing is used for this determination. The procedures for these tests are described in the document entitled "Interim Guidance for Application of Rapidly Rendered Harmless (RRH) and Trace Contaminants", which is available upon request from EC (P&Y). Ocean disposal options such as capping, containment, and side-casting, suggested by an applicant, will be considered by EC (P&Y), but their acceptance will be conditional on compliance with RRH protocols.

SAMPLING AND ANALYSIS REQUIREMENTS

The following pages identify the minimum sampling and analytical requirements for dredged and excavated materials based on the size of the project, as well as rejection/screening limits currently used by EC (P&Y). Sampling requirements will be tailored on a site specific basis at the discretion of EC (P&Y), and analysis of other parameters may be requested when EC (P&Y) has reason to believe that other contaminants are present.

MINIMUM REQUIREMENTS FOR DREDGED MATERIALS

SAMPLING REQUIREMENTS

All samples are analysed for minimum requirements.

Project Quantity (m^3)	Permit Type	Minimum # of Samples	Type of Sampling
0 - 4,000	General *	3 (1) **	• surface sampling prior to loading
0 - 10,000	Site-Specific	3 (1)	• surface sampling prior to loading
10,000 - 30,000	Site-Specific	3 (1) 3 (1) **or** 6 (2)	• surface sampling prior to loading • sampling to depth prior to loading • surface sampling prior to loading • may require additional sampling during dredging
30,000 - 60,000	Site-Specific	4 (2) 4 (2)	• surface sampling prior to loading • sampling to depth prior to loading
>60,000	Site-Specific	• sampling requirements to be determined on a project specific basis	

* General Permits are multi-loadsite permits issued to applicants, and are specific to disposal from maintenance dredging projects of less than 4000 cubic metres.

** The brackets indicate the number of *composite* samples to be analysed initially for dioxins/furans, if requested by EC (P&Y).

MINIMUM ANALYSIS REQUIREMENTS

	Parameter	Limit of Detection
Trace Metals	Mercury (Hg)	0.2 µg/g
	Cadmium (Cd)	0.2 µg/g
Organics	TPAH	0.1 µg/g
Other	TOC	
	Particle Size	

For PAH, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Interim Quality Assurance Guidelines for Determination of Polynuclear Aromatic Hydrocarbons in Marine Sediments for Ocean Disposal', a copy of which is available from EC (P&Y).

Should the site history reveal cause for environmental concern, an increased number of samples and/or analysis of other metals and/or organics may be requested. Additional parameters may include the following:

	Parameter	Limit of Detection
Trace Metals	Copper (Cu)	10 µg/g
	Zinc (Zn)	10 µg/g
	Arsenic (As)	10 µg/g
	Chromium (Cr)	10 µg/g
	Nickel (Ni)	10 µg/g
	Lead (Pb)	10 µg/g
Organics	PCB	0.05 µg/g
	PCP	0.05 µg/g
	Dioxins/furans	10 pg/g for T_4CDD

The analysis results are to be reported on a dry weight basis with detection limits less than or equal to those stated above. The precision of the test method should be indicated by reporting analyses on five replicate sub-samples on 10% of the trace metal samples, and two replicate sub-samples on 20% of the organics samples, with a minimum of one replicated sample. Sub-sampling should be done following homogenizing but prior to digestion of the sample and the replicates should not be run consecutively. The accuracy of the test method should be indicated by reporting the results of certified reference materials analysed at the same time as the test samples.

For dioxin/furan, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Internal Quality Assurance Requirements for Analysis of Dioxins in Environmental Samples', a copy of which is available from EC (P&Y).

MINIMUM REQUIREMENTS FOR EXCAVATION MATERIALS*

* "General" Permits for excavation spoils are restricted to the loading and ocean disposal of *undisturbed, native material*. For other excavated materials, a site specific permit will be required.

SAMPLING REQUIREMENTS

Project Quantity (m^3)	Minimum Number of Samples	Type of Sampling
0 - 10,000	3	• composite of surface native material to one metre depth
10,000 - 30,000	6	• composite of surface native material to one metre depth
30,000 - 60,000	8	• composite of surface native material to one metre depth
> 60,000	sampling requirements to be determined on a project specific basis	

MINIMUM ANALYSIS REQUIREMENTS

	Parameter	Limit of Detection
Trace Metals	Mercury (Hg)	0.2 µg/g
	Cadmium (Cd)	0.2 µg/g
	Lead (Pb)	10 µg/g
	Copper (Cu)	10 µg/g
	Zinc (Zn)	10 µg/g
	Arsenic (As)	10 µg/g
	Chromium (Cr)	10 µg/g
	Nickel (Ni)	10 µg/g
Organics	TPAH	0.1 µg/g
Other	TOC	
	Particle Size	

Should the site history reveal cause for environmental concern, an increased number of samples and/or analysis of other metals and/or organics may be requested.

The analysis results are to be reported as stipulated under Table 1. Minimum requirements for dredged materials.

REJECTION/SCREENING LIMITS

Parameter	Rejection/Screening Limit (µg/g dry weight)
Cadmium	0.6 µg/g
Mercury	0.75 µg/g
Arsenic Copper Zinc Beryllium Chromium Nickel Vanadium Lead	* 0.1 % or more by weight or 1000 µg/g
Chlorophenols (PCP) (penta and tetra isomers)	1.0 µg/g
Polychlorinated biphenyls (PCB)	0.1 µg/g
PAH (total)	2.5 µg/g
Dioxin/Furan	"quantifiable" 2,3,7,8 TCDD

* These levels are defined as "significant amounts" as agreed to by Canada as a signatory to the London Convention (LC); if exceeded, special care measures are required for disposal. *EC (P&Y) considers these levels as general guidelines only and may impose more stringent limits.*

STEPS REQUIRED FOR COLLECTING SAMPLES AND SUBMITTING ANALYTICAL DATA

Prepare the following information:

1) a location map for the dredge/excavation site with the the street address of the proposed excavation or dredge site,
2) a site map showing the proposed excavation or dredge site relative to known landmarks and/or streets,
3) a list of any known possible contaminant input sources in the vicinity of the proposed works,
4) a written record of the decision making process used in selecting ocean disposal as the preferred materials disposal option, explaining why other disposal methods are not being used,
5) a site use history for the site from which the material destined for ocean disposal will originate, and
6) a proposed sampling plan of the site showing the proposed sampling locations, and a list of proposed analyses. The proposed sampling plan should be developed based on information presented in this document. Assistance in designing a sampling program can be provided by Environment Canada (EC), Pacific and Yukon Region (P&Y). *The sampling program must be approved prior to taking the samples.*

The information identified above should be sent to EC (P&Y). If the project does not qualify for completion under the terms and conditions of a "General" permit, this information should be submitted with a completed Ocean Disposal Application form. For information on how to apply, please contact EC (P&Y).

If the project qualifies for completion under a "General" Ocean Disposal Permit, this information must be submitted to EC (P&Y) with a covering letter describing the proposed activities in detail, and the proposed schedule for the work. Upon completion of the sampling and analyses program, the test data, together with all QA/QC data as identified in the foregoing information, must be sent to EC (P&Y).

No work may proceed under a "General" Permit until written approval for the specific site has been received from EC (P&Y), and a copy of the approval letter is posted at the work site.

For further information on this document, or any other matter relating to Ocean Disposal, please contact the following:

Dixie Sullivan	(604) 666-2730
Duane Brothers	(604) 666-0724
Cathy Schnider	(604) 666-2685

GENERAL GUIDE TO SOIL AND SEDIMENT SAMPLE COLLECTION

Containers for the samples should be obtained from the laboratory contracted to conduct the required analyses. Avoid unnecessary contact with clean glassware and utensils. A clean stainless steel or teflon spoon or scoop is ideal for transferring samples. Handle containers by the outsides only. Do not touch the inside of the jar, or teflon (or foil) liners, and use spoons or scoops by the handles only. When removing a foil or teflon liner and lid from a jar, remove as one piece and put down on a piece of foil or other clean surface while filling the jar.

If using a grab sampler, remove the water from the surface of the grab, taking care not to disturb the contents if possible. Use the clean scoop to remove a portion of the sediment from the middle of the sampler down to the depth of the material caught in the grab. The material in the sample jar should be representative of the material to be loaded for ocean disposal.

Alternatively, the sample may be taken by removing the lid, holding the jar by the sides and scooping the sample from the sediment without the use of other utensils. The threads of the jar may then be wiped with a paper towel before replacing the lid. Do not fill the jar more than about 3/4 full, allowing plenty of room for mixing/stirring, and expansion during freezing.

When the sample is in the jar, replace the teflon/foil liner and lid, and label the jar with project identification, the sampling site number, and the date.

To clean the sampling spoon or grab in-between samples, wipe with a paper towel to remove any solids, then rinse with water. Clean the tray in this manner as required.

If three samples are required for analysis, three small jars of sediment should be taken for *each* sampling station, for a total of nine jars. The three jars per sample will be composited by the analytical lab by taking equal aliquots of sample from each jar for a single analysis of most parameters of concern. The samples may be further composited for other testing as required but would otherwise be maintained as discrete samples.

Keep the samples in a refrigerator or on ice for short term storage (1-2 days); freeze the sample as soon as possible or store over dry ice for long term storage. The laboratory responsible for the analyses should be asked to freeze the samples after removal of sufficient material to complete the required analyses. These samples should remain frozen until the permit, or approval under a general permit, has been issued by EC (P&Y).

APPENDIX II

Ocean Disposal Site Summaries

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Point Grey
Number 1
Lattitude 49°15.40
Longitude 123°22.10
Depth (m) 210

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3124	FR-MAINTENANCE	27-Feb-96	6,200 m3
	3126	FRNA-RICHMOND PLYWOOD	11-Mar-96	11,000 m3
	3130	FRNA-SCOTT PAPER LTD	10-Jan-96	4,000 m3
		FR-ACORN-PRIMEX	13-Jan-96	2,000 m3
		FRNA-WESTERN WHITEWOOD	16-Jan-96	1,000 m3
		FR-TILBURY ISLAND-BCFP/CN	08-Feb-96	50 m3
		VAN HBR-REED POINT MARINA	28-Feb-96	700 m3
		FRNA-TERMINAL SAWMILL	09-Mar-96	2,500 m3
		FRNA-WESTERN WHITEWOOD	17-Apr-96	1,500 m3
		FR-CIPA LUMBER	03-Jun-96	2,000 m3
	3131	FR-MACKENZIE MILLS	20-Mar-96	2,000 m3
		FR-MACKENZIE MILLS	29-Mar-96	2,000 m3
		FR-ACORN-PRIMEX	01-Apr-96	1,000 m3
	3132	FR-DELTA CEDAR	15-Jan-96	1,000 m3
		FR-DELTA CEDAR	23-Mar-96	1,200 m3
	3135	VAN HBR-FALSE CREEK-GRANVILL	27-Feb-96	850 m3
		FRNA-KIEWIT	17-Jul-96	1,100 m3
		VAN HBR-FALSE CREEK-GRANVILL	18-Jul-96	300 m3
	3138	FRNA-MB-NW	08-Jan-96	5,150 m3
	3141	VAN HBR-CONAG NORTH VAN	02-Jan-96	1,300 m3
		VAN HBR-FALSE CREEK-GRANVILL	04-Jan-96	1,600 m3
		VAN HBR-F&N LOG SORT	29-Feb-96	4,000 m3
	3146	FRNA-GOLDWOOD IND	23-Mar-96	1,000 m3
		FR-VALIANT LOG SORT	31-Mar-96	1,000 m3
		FR-PACIFIC CUSTOM LOG SORT	09-Apr-96	3,000 m3
		FRNA-GOLDWOOD IND	31-Jul-96	1,000 m3
		FR-NORVIK LUMBER	26-Aug-96	1,000 m3
		VAN IS-CHEMAINUS RIVER FLATS	29-Aug-96	500 m3
	3152	FR-MILL & TIMBER	17-Apr-96	14,400 m3
		FR-MILL & TIMBER	12-Oct-96	4,000 m3
	3154	FR-S&R SAWMILLS	18-Sep-96	43,406 m3
	3155	FRNA-WEST COAST CELLUFIBRE	18-Jun-96	2,000 m3
		FRNA-LAFARGE-KENT ST	19-Jun-96	1,000 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Dredge	3155	FR-ACORN-PRIMEX	30-Jun-96	1,000 m3
		VAN HBR-FALSE CREEK	27-Aug-96	300 m3
		FR-MACKENZIE MILLS	06-Oct-96	1,500 m3
		FRNA-EBURNE	11-Oct-96	1,400 m3
		FRNA-WEST COAST CELLUFIBRE	18-Oct-96	1,500 m3
		FR-ACORN-PRIMEX	27-Oct-96	2,000 m3
		FRNA-REMPLE BROTHERS	02-Dec-96	2,000 m3
		FR-CONAG-DUCK ISLAND	02-Dec-96	500 m3
	3156	FRNA-VAN SAWMILL	08-Jun-96	3,000 m3
		FR-DELTA CEDAR	02-Jul-96	4,000 m3
		FRNA-WESTERN WHITEWOOD	24-Jul-96	800 m3
		FR-FRASER MILLS	07-Sep-96	2,500 m3
		FR-DELTA CEDAR	15-Sep-96	800 m3
		VAN HBR-REED POINT MARINA	24-Sep-96	150 m3
		FR-FRASER CEDAR	19-Oct-96	1,200 m3
		FRNA-WESTERN WHITEWOOD	29-Oct-96	1,500 m3
		FRNA-SCOTT PAPER LTD	03-Nov-96	1,500 m3
		FRNA-MAINLAND SAWMILL	08-Nov-96	4,000 m3
		FRNA-SILVERTREE SAWMILLS	09-Nov-96	4,000 m3
		FRNA-RICHMOND PLYWOOD	24-Nov-96	1,500 m3
		FR-FRASER MILLS	30-Nov-96	3,000 m3
		FR-DELTA CEDAR	30-Nov-96	1,000 m3
	3158	FRNA-CANADIAN WHITE PINE	29-Jul-96	3,450 m3
		FRNA-MB-NW	08-Aug-96	3,450 m3
		FRNA-CANADIAN WHITE PINE	12-Aug-96	4,350 m3
		FRNA-MB-NW	23-Dec-96	2,500 m3
	3160	FR-TEAL CEDAR	14-Nov-96	3,007 m3
		FR-FRASER PULP CHIP	14-Nov-96	4,000 m3
	3165	FRPD-FLAVELLE CEDAR	02-Sep-96	16,000 m3
	3166	FRNA-GOLDWOOD IND	05-Aug-96	15,500 m3
	3168	VAN HBR-PACIFIC COAST TERMIN	29-Oct-96	350 m3
			Total Dredge Quantity:	216,513 m3
Excavation	3136	LOWER MAINLAND-MILLER	01-Jan-96	26,558 m3
		LOWER MAINLAND-MILLER	01-Feb-96	9,101 m3
		LOWER MAINLAND-MILLER	01-Mar-96	14,777 m3
		LOWER MAINLAND-MILLER	01-Apr-96	22,659 m3
		LOWER MAINLAND-MILLER	01-May-96	14,994 m3
		LOWER MAINLAND-MILLER	01-Jun-96	18,557 m3
		LOWER MAINLAND-MILLER	01-Jul-96	29,078 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Excavation	3136	LOWER MAINLAND-MILLER	01-Aug-96	12,502 m3
	3140	LOWER MAINLAND-BEL	01-Jan-96	17,940 m3
		LOWER MAINLAND-BEL	01-Feb-96	6,882 m3
		LOWER MAINLAND-BEL	01-Mar-96	24,141 m3
		LOWER MAINLAND-BEL	01-Apr-96	32,252 m3
		LOWER MAINLAND-BEL	01-May-96	19,712 m3
		LOWER MAINLAND-BEL	01-Jun-96	7,131 m3
		LOWER MAINLAND-BEL	01-Jul-96	969 m3
	3148	LOWER MAINLAND-CONAG-NORT	19-Jan-96	21,623 m3
		LOWER MAINLAND-CONAG-NORT	01-Nov-96	13,160 m3
		LOWER MAINLAND-CONAG-NORT	01-Dec-96	16,338 m3
	3159	LOWER MAINLAND-MILLER	22-Aug-96	5,476 m3
		LOWER MAINLAND-MILLER	01-Sep-96	12,607 m3
		LOWER MAINLAND-MILLER	01-Oct-96	5,649 m3
		LOWER MAINLAND-MILLER	01-Nov-96	9,023 m3
		LOWER MAINLAND-MILLER	01-Dec-96	12,159 m3
	3163	LOWER MAINLAND-BEL	03-Jul-96	12,542 m3
		LOWER MAINLAND-BEL	01-Aug-96	13,347 m3
		LOWER MAINLAND-BEL	01-Sep-96	23,012 m3
		LOWER MAINLAND-BEL	01-Oct-96	20,470 m3
		LOWER MAINLAND-BEL	01-Nov-96	11,868 m3
		LOWER MAINLAND-BEL	01-Dec-96	2,379 m3
		Total Excavation Quantity:		436,906 m3
		Total Disposal Site Quantity:		653,419 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Sand Heads
Number 9
Lattitude 49°06.00
Longitude 123°19.50
Depth (m) 70

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3147	FR-ANNACIS CHANNEL-UTILITY	22-Jan-96	8,500 m3
		FR-ANNACIS CHANNEL-UTILITY	16-Aug-96	800 m3
	3155	FR-CONAG-DELTA	02-Dec-96	2,000 m3
		FR-CONAG-SURREY	02-Dec-96	3,000 m3
	3156	FR-TILBURY ISLAND-BCFP/CN	05-Nov-96	4,000 m3
	3160	FR-RITCHIE BROTHERS	28-Nov-96	1,200 m3
		LOWER MAINLAND-MILLER	03-Dec-96	3,800 m3
			Total Dredge Quantity:	23,300 m3
			Total Disposal Site Quantity:	23,300 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Porlier Pass
Number 32
Lattitude 49°00.20
Longitude 123°29.80
Depth (m) 200

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3146	VAN IS-LADYSMITH-CPFP-DRYSOR	20-Jul-96	1,500 m3
		VAN IS-CHEMAINUS-SAWMILL	23-Jul-96	1,500 m3
		VAN IS-CHEMAINUS-MB-DRYSORT	26-Jul-96	1,500 m3
			Total Dredge Quantity:	4,500 m3
			Total Disposal Site Quantity:	4,500 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Five Finger Island
Number 40
Lattitude 49°15.20
Longitude 123°54.60
Depth (m) 280

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3142	VAN IS-MB-ISLAND PHOENIX	24-Jun-96	300 m3
	3157	VAN IS-DOMANS-DUKE PT	29-Jun-96	1,800 m3
		VAN IS-LADYSMITH-DOMANS	03-Jul-96	1,800 m3
			Total Dredge Quantity:	3,900 m3
			Total Disposal Site Quantity:	3,900 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Comox (Cape Lazo)
Number 48
Lattitude 49°41.70
Longitude 124°44.50
Depth (m) 190

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3156	VAN IS-COURTENAY RIVER	02-Aug-96	4,000 m3
			Total Dredge Quantity:	4,000 m3
			Total Disposal Site Quantity:	4,000 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Malaspina Strait
Number 49
Lattitude 49°45.00
Longitude 124°27.00
Depth (m) 320

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3167	POWELL RIVER	21-Sep-96	25,561 m3
			Total Dredge Quantity:	25,561 m3
			Total Disposal Site Quantity:	25,561 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Thornbrough Channel
Number 64
Lattitude 49°31.00
Longitude 123°28.30
Depth (m) 220

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3130	HOWE SD-TERMINAL FORESTS	01-Apr-96	4,000 m3
	3156	HOWE SD-CN DANROTH	16-Aug-96	4,000 m3
			Total Dredge Quantity:	8,000 m3
			Total Disposal Site Quantity:	8,000 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Port Alberni
Number 88
Lattitude 49°11.80
Longitude 124°49.30
Depth (m) 45

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3127	VAN IS-CHINA CREEK MARINA	22-Jan-96	400 m3
		Total Dredge Quantity:		400 m3
		Total Disposal Site Quantity:		400 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Kitimat Arm
Number 93
Lattitude 53°58.00
Longitude 128°41.50
Depth (m) 176

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3156	KITIMAT-EUROCAN	25-Sep-96	100 m3
			Total Dredge Quantity:	100 m3
			Total Disposal Site Quantity:	100 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Brown Passage
Number 100
Lattitude 54°18.70
Longitude 130°45.00
Depth (m) 180

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Vessel	3153	FERN PASSAGE	15-May-96	563 tonnes
			Total Vessel Quantity:	563 tonnes
			Total Disposal Site Quantity:	563 tonnes

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Johnstone Strait-Hickey Point
Number 119
Lattitude 50°27.80
Longitude 126°04.80
Depth (m) 270

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3145	VAN IS-KELSEY BAY-MB	18-Jan-96	3,600 m3
			Total Dredge Quantity:	3,600 m3
			Total Disposal Site Quantity:	3,600 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Johnstone Strait-Hanson Island
Number 120
Lattitude 50°33.50
Longitude 126°48.00
Depth (m) 350

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3145	VAN IS-PORT MCNEILL-MB	01-Jan-96	1,200 m3
		VAN IS-PORT MCNEILL-WESTERN	03-Jan-96	2,400 m3
		VAN IS-BEAVER COVE-CANFOR	08-Jan-96	1,800 m3
		GILFORD ISLAND-SCOTT COVE	16-Jan-96	600 m3
			Total Dredge Quantity:	6,000 m3
			Total Disposal Site Quantity:	6,000 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Squamish
Number 164
Lattitude 49°40.70
Longitude 123°10.90
Depth (m) 80

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3120	HOWE SD-MAMQUAM	01-Feb-96	6,450 m3
			Total Dredge Quantity:	6,450 m3
			Total Disposal Site Quantity:	6,450 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Shingle Bay, Q.C.I.
Number 174
Lattitude 53°14.95
Longitude 131°52.10
Depth (m) 51

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3086	QCI-SANDSPIT	02-Jan-96	179,600 m3
			Total Dredge Quantity:	179,600 m3
			Total Disposal Site Quantity:	179,600 m3

Disposal Site History Report

For Disposal Activities Between 01/01/96 and 31/12/96

Disposal Site Maud Island
Number 178
Lattitude 50°08.00
Longitude 125°14.80
Depth (m) 32

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Vessel	3151	VAN IS-CAMPBELL RIVER-MARINA	22-Jun-96	2,400 tonnes
		Total Vessel Quantity:		2,400 tonnes
		Total Disposal Site Quantity:		2,400 tonnes